Archimedes

300/400 Series

Product Support and Service Training

Course Notes

BRITISH
BROADCASTING
CORPORATION

Acorn
The choice of experience.

Section Zero
Section Index

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 0 : SECTION INDEX

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Section One
Course Guide and Introduction

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 1 : COURSE GUIDE AND INTRODUCTION

CONTENTS

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Notes

What Is RISC?

RISC is an abbreviation for "Reduced Instruction Set Computer".

In the development of the conventional processor the instruction set has become more and more complex. This has led to very powerful processors but at the expense of reduced production yields and therefore higher costs.

The actions to be performed by the processor when an instruction is received are contained in a ROM on the processor chip in the form of micro code. These codes are similar to a computer program written by the operator and can involve branching and looping within the instruction.

When an instruction is applied to the processor the time taken to recognise and decode it can be quite significant particularly on a large processor able to respond to many different instructions.

Often the more complex micro code routines could be carried out quicker using a number of simpler instructions and many complex instructions, which take up valuable chip area, may be underused.

When a complex instruction activates a lot of processor elements, the instruction cycle must be long enough to allow all the elements to respond. Some less complex instructions may therefore have a period of dead time within them.

If the more complex instructions are removed the effect can be to increase the execution time of the simpler ones. This also leaves more chip area available for other useful applications.

Pipelining

A futher method of increasing the processor speed is that of Pipelining. This involves a technique of fetching the next instruction whilst the previous instruction is being decoded and the one prior to that is being executed.

In a conventional processor the processor is idle whilst an instrucion is being fetched from memory and whilst an instruction is being executed the bus to the memory is idle. In the RISC processor the circuitry to control "fetching", "decoding" and "executing" are all separate thus processing speed is increased.

One area where this technique cannot work is when a branch instruction is encountered. Under this condition the next instruction will have already been fetched but will not be the one required. To overcome this the pipeline is flushed to remove this instruction, thus there is no point in having a long pipeline.

In order to avoid too many branches all the instructions used are conditional. This ensures that branching ony becomes necessary for loops and long jumps and branching is no longer required to just skip a small amount of code.

Why Acorn Use RISC

Micro technology is moving forward at an increasing pace and Acorn, being a leader in the micro computer field realised that a leap from 8 bit to 16 bit was insufficient.

The decision was made to look for a suitable 32 bit microprocessor family that would fulfil a role in the new generation of machines.

The specification was :-

1. Must be cost effective. i.e., It had to be able to provide the basis for a computer that was forward looking but market priced.

2. The entire computer had to be small enough to be desk top.

3. The memory had to be expandable.

The RISC chip gave all of these things and more.

It is very fast but easy to use.

No need to program in M/C as BASIC is fast enough for a host of applications.

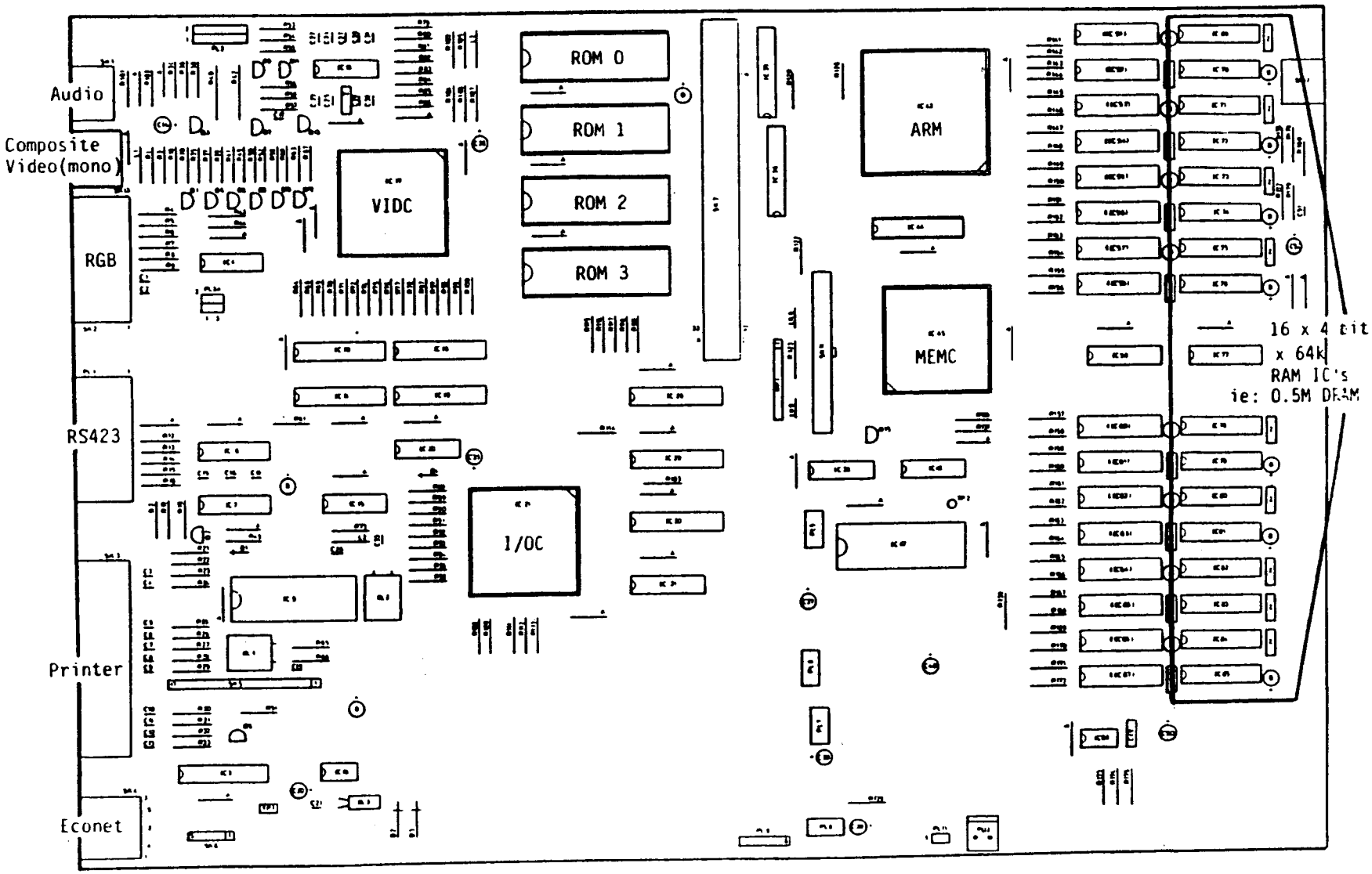


Figure 1.2 Archimedes 300 Series PCB Layout.

The ARM IC

The ARM (Acorn RISC Machine) is a general purpose 32-bit single-chip microprocessor. The architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are greatly simplified compared with microprogrammed Complex Instruction Set Computers. This simplification results in a high instruction throughput and a good real-time interrupt response from a small and cost-effective chip.

The instruction set comprises nine basic instruction types. Two of these make use of the on-chip arithmetic logic unit (ALU), barrel shifter and multiplier to perform high-speed operations on the data in a bank of 27 registers, each 32 bits wide. Two instruction types control the transfer of data between main memory and the register bank, one optimised for flexibility of addressing and the other for rapid context switching. Two instructions control the flow and privilege level of execution, and the remaining three types are dedicated to the control of external Co-Processors which allow the functionality of the instruction set to be extended off-chip in an open and uniform way.

The ARM instruction set has proved to be a good target for compilers of many different high-level languages. Where required for critical code segments, assembly code programming is also straightforward, unlike some RISC processors which depend on sophisticated compiler technology to manager complicated instruction interdependencies.

Pipelining is employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruciton is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The memory interface has been designed to allow the performance potential to be realised without incurring high costs in the memory system. Speed critical control signals are pipelined to allow system control functions to be implemented in standard low-power logic, and these control signals facilitate the exploitation of the fast local access modes offered by industry standard dynamic random access memories (DRAMs).

Features

* 32-bit data bus
* 26-bit address bus giving a 64-MByte uniform address space
* Support for virtual memory systems
* Simple but powerful instruction set
* Co-Processor interface for instruction set extension
* Good high-level language compiler support
* Peak execution rate of 10 million instructions per second (MIPS)
* Fast interrupt response for real-time applications
* Low power consumption (0.1 W typical) with a single +5V supply
* 84-pin JEDEC B leadless chip carrier or plastic leaded chip carrier

The VIDC IC

The Video Controller (VIDC) accepts video data from memory under DMA control, serialises and passes it thorugh a colour look-up palette, and converts it to analog signals for driving the CRT guns. The chip also controls all the display timing parameters and controls the position and pattern of the cursor sprite. In addition, the VIDC incorporates an exponential DAC and stereo image table for the generation of high quality sound from data in the memory.

The VIDC requests data from the memory when required, and buffers it in one of three FIFOs before using it. Note that the addressing of the data in memory is controlled elsewhere in the system (usually in the Memory Controller, MEMC). Data is requested in blocks of four 32-bit words, allowing efficient use of paged-mode DRAM without locking up the system data bus for long periods.

The VIDC is a highly programmable device, offering a very wide choice of display formats. The pixel rate can be selected in a range between 8 and 24MHz and the data can be serialised to either 8, 4, 2 or 1 bit per pixel. The horizontal timing parameters can be controlled to units of 2 pixels and the vertical timing parameters can be controlled to units of a raster. The colour look-up palette which drives the three on-chip DACs is 13 bits wide, offering a choice from 4096 colours or an external video source.

Extensive use is made of pipelining throughout the device.

The cursor sprite is 32 pixels wide, and any number of rasters high. It can be positioned anywhere on the screen. Three simultaneous colours (again from a choice of 4096) are supported, and any pixel can be defined as transparent, making possible cursors of many shapes.

The sound system implemented on the device can support up to 8 channels, each with a separate stereo position.

It should be noted that there are two variants of the VIDC, designated VIDC1 and VIDC2. The two devices are identical apart from two aspects: the sense of the video DACs; and the order of the bits in the sound DAC.

Features

* pixel rate selectable as 8, 12, 16 or 24MHz
* serialises data to 1, 2, 4 or 8 bits per pixel
* 16 word by 4096 colour look-up palette
* 4-bit DACs for each CRT gun
* highly programmable screen parameters
* border facility
* cursor sprite
* optional interlaced sync. display format
* allowance for external synchronisation
* very high resolution monochrome mode
* high quality stereo sound generation
* fabricated in CMOS for low power

A simple comparison between the 6502 processor instruction set and that of the ARM processor shows that although the ARM processor is many times more powerful, its instruction set is very straight forward.

6502 Instruction Set

Mnemonic Code	Operation Performed	Status Flags							
		N	V		B	D	I	Z	C
ADC	Add memory to accumulator with carry	X	X					X	X
AND	AND memory with accumulator	X						X	
ASL	Shift left one bit (memory or accum.)	X						X	X
BCC	Branch on carry clear (If C=0)								
BCS	Branch on carry set (If C=1)								
BEQ	Branch on result zero (If Z=1)								
BIT	Test bits in accumulator with memory	X	X					X	
BMI	Branch on result minus (If N=1)								
BNE	Branch on result not zero (If Z=0)								
BPL	Branch on result plus (If N=0)								
BRK	Force break						1		
BVC	Branch on overflow clear (If V=0)								
BVS	Branch on overflow set (If V=1)								
CLC	Clear carry flag								0
CLD	Clear decimal mode					0			
CLI	Clear interrupt disable flag						0		
CLV	Clear overflow flag		0						
CMP	Compare memory and accumulator	X						X	X
CPX	Compare memory and index X	X						X	X
CPY	Compare memory and index Y	X						X	X
DEC	Decrement memory by one							X	X
DEX	Decrement index X by one							X	X
DEY	Decrement index Y by one							X	X
EOR	Exclusive OR memory with accumulator							X	X
INC	Increment memory by one							X	X
INX	Increment index X by one							X	X
INY	Increment index Y by one							X	X
JMP	Jump to new location								
JSR	Jump to new location save rtn. add.								
LDA	Load accumulator from memory							X	X
LDX	Load index X from memory							X	X
LDY	Load index Y from memory							X	X
LSR	Shift right one bit (memory or accum.)	0						X	X
NOP	No operation								
ORA	OR memory with accumulator	X						X	
PHA	Push accumulator on stack								
PHP	Push processor status on stack								
PLA	Pull accumulator from stack							X	X
PLP	Pull processor status from stack	X	X	X	X	X	X	X	X
ROL	Rotate one bit left (mem. or accum.)	X						X	X
ROR	Rotate one bit right (mem. or accum.)	X						X	X
RTI	Return from interrupt	X	X	X	X	X	X	X	X
RTS	Return from subroutine								
SBC	Subtract memory and borrow from accum	X	X					X	X
SEC	Set carry flag								1
SED	Set decimal mode					1			
SEI	Set interrupt disable flag						1		
STA	Store accumulator in memory								
STX	Store index X in memory								
STY	Store index Y in memory								
TAX	Transfer accumulator to index X	X						X	
TAY	Transfer accumulator to index Y	X						X	
TSX	Transfer stack pointer to index X	X						X	
TXA	Transfer index X to accumulator	X						X	
TXS	Transfer index X to stack pointer								
TYA	Transfer index Y to accumulator	X						X	

Notes

Section Two
The Archimedes Series

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 2 : THE ARCHIMEDES SERIES

CONTENTS

1 THE 300 AND 400 RANGE

Introduction

There will be two ranges in the A Series. The 300 range and the 400 range.

The 300 Range (System 300)

The 300 range will be the "BBC" badged and have limited RAM and lower entry features.

This range will initially consist of two micros - the A305 and the A310.

The 400 Range (System 400)

The 400 Range will be Acorn branded and have a larger RAM and higher entry features.

Table 2.1 shows the features of both the BBC badged 300 series and the Acorn badged 400 series.

The 400/1 Range

The A3000

The R140

VDU Controls

All necessary function controls are fitted with the most important at the front beneath a flip down lid, and less important at the rear.

Monitor Options

Acorn will supply two monitors initially :-

i) 12" Mono hi-resolution screen

ii) 14" Medium Resolution Colour (0.42mm dot pitch)
(This uses a SCART input Analogue RGB. The connecting lead is supplied.)

Also usable on :-

i) Any Monochrome monitor with Composite Video Input.

ii) Medium resolution colour monitor with Analogue RGB input.

iii) Dual Scan Colour monitor, eg., NEC Multisync to support 640 x 512 non-interlaced mode.

Note: A domestic television is not suitable for Archimedes.
An RF modulator will not be available.

International Capability

Voltages

* PSU designed to inherently support 220/240V or 110V in conjunction with alternative mains lead. The voltage set during PSU manufacture.

Safety

* Designed to meet IEC, UL, CSA, BSI specifications.

* Product must be earthed, but Double Insulation is used in PSU to enhance safety.

RFI

* Designed to meet European CISPR standards, i.e., should meet BSI, FTZ, FCC requirements.

* Full testing in process. Some design modifications may be needed following test.

2. PODULES

Introduction

Prior to a podule being fitted it is necessary to fit a backplane and fan assembly. The backplane consists of an adaptor PCB/Socket assembly that plugs directly into the mother board and supplies, depending on the model, up to 4 sub sockets. Each sub socket is capable of sustaining 1 Podule.

A bracket assembly is also supplied to give mechanical strength to the backplane.

Due to the increased current consumption the internal case temperature could rise beyond permissible limits and a fan must be fitted to reduce this risk. The fan supplied fits to the forward LHS of the machine.

A Podule (peripheral module) is a means of expanding the A series computer without the need for tools or alterations to the mother PCB etc.

The Podule is designed to the Eurocard standard and is fitted into a backplane inside the machine.

A DIN 41612 Euroconnector socket is mounted on the mother PCB and connects to the backplane. Rows A and C are connected on 300 series (i.e., 64 way). Row B is additionally connected on the 400 series.

Up to four podules can be fitted, depending on the model.

Types of Podule

At present there are four basic types of podule :-

1. Simple Podules
2. MEMC Podules
3. Coprocessor Podules
4. External Podules

Simple Podules

These podules occupy the IOC address space allocated to podules, and are accessed via one of the four IOC cycle types. An example of a simple podule would be the provision of a 1MHz bus.

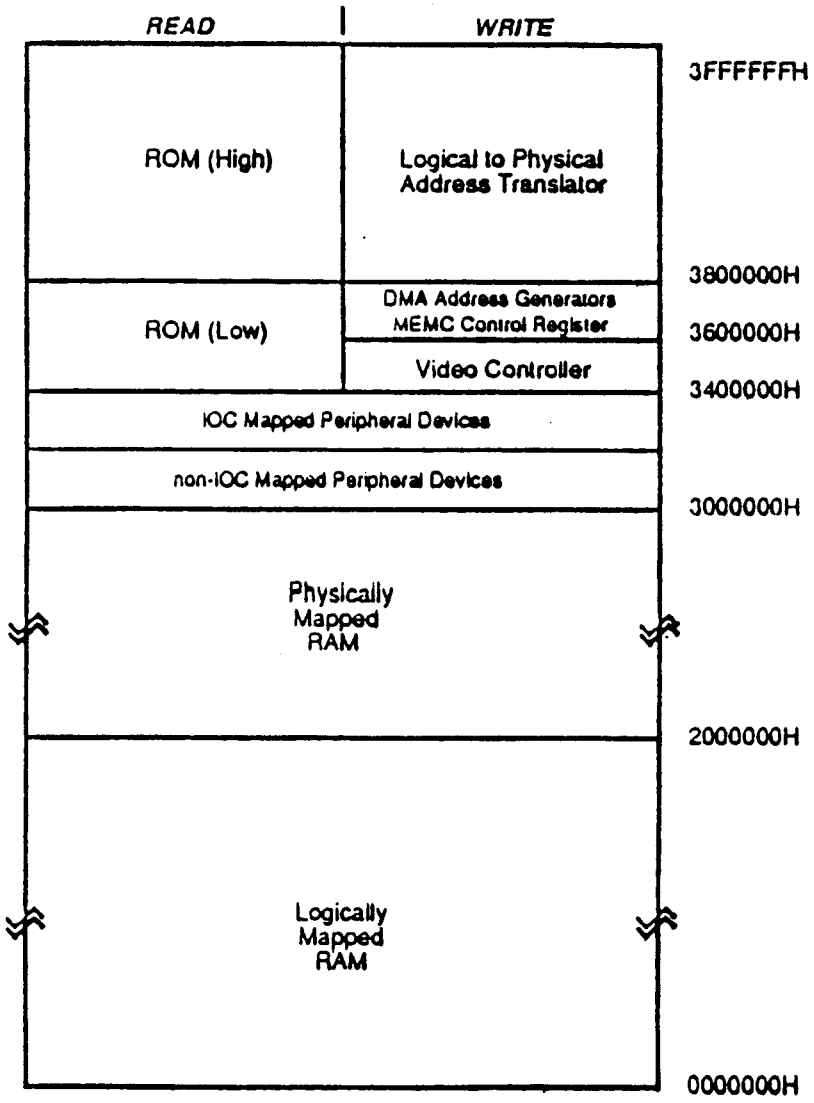


Figure 2.1 Podule Interfacing Memory Map Location

Main PCB Connector

Referring to Table 2.2.

The connector fitted to the main PCB in the computer is shown below but does not include power supply pins. These are received by the backplane directly from the PSU.

pin	a	b	c	
1	0V	D[0]	0V	
2	LA[15]	D[1]	-5V	
3	LA[14]	D[2]	0V	
4	LA[13]	D[3]	0V	
5	LA[12]	D[4]	SPVMD	
6	LA[11]	D[5]	LA[21]	
7	LA[10]	D[6]	CPA	
8	LA[9]	D[7]	CPB	
9	LA[8]	D[8]	CPI	
10	LA[7]	D[9]	OPC	
11	LA[6]	D[10]	PHI2	
12	LA[5]	D[11]	$\overline{RST}$	
13	LA[4]	D[12]	$\overline{PR/W}$	
14	LA[3]	D[13]	$\overline{PWE}$	
15	LA[2]	D[14]	$\overline{PRE}$	
16	BD[15]	D[15]	$\overline{PIRQ}$	
17	BD[14]	D[16]	$\overline{PFIQ}$	
18	BD[13]	D[17]	*reserved*	
19	BD[12]	D[18]	C1	
20	BD[11]	D[19]	C0	
21	BD[10]	D[20]	$\overline{EXTPS}$	
22	BD[9]	D[21]	$\overline{S4}$	master podule select
23	BD[8]	D[22]	$\overline{IOGT}$	
24	BD[7]	D[23]	$\overline{IORQ}$	
25	BD[6]	D[24]	$\overline{BL}$	
26	BD[5]	D[25]	0V	
27	BD[4]	D[26]	CLK2	
28	BD[3]	D[27]	CLK8	
29	BD[2]	D[28]	REF8M	
30	BD[1]	D[29]	0V	
31	BD[0]	D[30]	DBE	
32	0V	D[31]	0V	

Table 2.2 Main PCB Connector

All signals from the main PCB are CMOS logic levels. Podules may drive the bus with TTL levels, but CMOS levels are recommended.

The voltages obtained from the PSU are :-

-5V	50mA
+5V	1A
+12V	250mA

Currents in excess of those shown may be drawn for short periods.

The use of +12V and -5V is not to be recommended unless it is absolutely necessary. Some machines may not support these voltages.

pin	a	b	c	
1	0V	D[0]	0V	
2	LA[15]	D[1]	-5V	
3	LA[14]	D[2]	0V	
4	LA[13]	D[3]	0V	
5	LA[12]	D[4]	SPVMD	supervisor mode
6	LA[11]	D[5]	$\overline{MS}$	
7	LA[10]	D[6]	CPA	coprocessor absent
8	LA[9]	D[7]	CPB	coprocessor busy
9	LA[8]	D[8]	CPI	coprocessor instruction
10	LA[7]	D[9]	OPC	op-code fetch
11	LA[6]	D[10]	$\overline{PH12}$	ARM phase 2 clock
12	LA[5]	D[11]	$\overline{RST}$	
13	LA[4]	D[12]	PR/ $\overline{W}$	
14	LA[3]	D[13]	$\overline{PWE}$	
15	LA[2]	D[14]	$\overline{PRE}$	
16	BD[15]	D[15]	$\overline{PIRQ}$	
17	BD[14]	D[16]	$\overline{PFIQ}$	
18	BD[13]	D[17]	*reserved*	
19	BD[12]	D[18]	C1	
20	BD[11]	D[19]	C0	
21	BD[10]	D[20]	$\overline{EXTPS}$	
22	BD[9]	D[21]	$\overline{PS}$	
23	BD[8]	D[22]	$\overline{IOGT}$	
24	BD[7]	D[23]	$\overline{IORQ}$	
25	BD[6]	D[24]	$\overline{BL}$	
26	BD[5]	D[25]	0V	
27	BD[4]	D[26]	CLK2	
28	BD[3]	D[27]	CLK8	
29	BD[2]	D[28]	REF8M	
30	BD[1]	D[29]	+5V	
31	BD[0]	D[30]	DBE	ARM data bus enable
32	+5V	D[31]	+12V	

Table 2.4 The Coprocessor Podule Interface

Section Three
Connection and Operation of Archimedes

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 3 : CONNECTION AND OPERATION OF ARCHIMEDES

CONTENTS

1. CONNECTING UP THE SYSTEM AND GETTING STARTED

The Computer/Keyboard Pack

The package total is two boxes.

Box 1 contains :	Monitor (Mono or Colour)	
Box 2 contains :	1 x keyboard	) within Poly Clam Shell
	1 x computer	)
	1 x Mains lead	)
	1 x Mouse	)
	1 x Welcome Guide	)
	1 x User Guide	) In upper part of
	1 x Welcome Disc	) Clam Shell
	1 x Registration Card	)
	1 x Guarantee Card	)
	1 x Acorn/3rd Party Sales List	)

Any shortages must be notified immediately.

Connection Of Hardware

Referring to Figure 3.1.

The system is designed to take advantage of the module technique.

The system consists of :-

1. Monitor (optional)
2. Computer
3. Keyboard
4. Mouse

The keyboard connects to the computer via a coiled lead and connects to the front RHS of the computer.

The mouse plugs into the rear RHS of the keyboard with sufficient cable to manoeuvre the mouse over a large area.

Colour Monitor - A lead terminated in a SCART socket (euro-connector) connects the computer to the VDU. The computer end of this lead is terminated in a 9 pin D Socket.

Monochrome Monitor - A phono-phono lead is required for connection of computer to VDU via Video Out socket.

The Computer/Disc Drive

The Computer/Disc Drive comes in a metal cabinet with a two tone plastic moulding at the front.

Front

The RHS of the moulding is designed to allow access to the $3\frac{1}{2}$" floppy drive.

To the LHS of the moulding is fitted the loudspeaker. This is rated at 0.2W 8 ohms.

Two LEDs adjacent to the speaker provide "Power On" and additional "Disc Drive On" indication (if fitted).

The keyboard socket is located at the bottom of RHS of the moulding and consists of 1 x 6 pin mini DIN socket.

Rear

Referring to Figure 3.1.

The rear of the computer comprises of a moulded frame housing :-

The Power Panel - This comprises of a moulded Euro mains input plug rated at 0.9A and moulded Euro mains output socket rated at 0.5A (unswitched). A mains ON/OFF rocker switch adjacent to the mains output socket provides power isolation to the main computer PSU but not to the output socket.

Rear Panel - This consists of three sections.

The bottom section contains the various input/output peripheral ports :-

a) Printer
b) RS423
c) Analogue RGB
d) External audio O/P (approx 600mV)
e) Econet (note that Econet interfacing is not included on main PCB)

The centre plate and top plate are fitted as blanking plates. If additional facilities are fitted via podule(s) then the blanking plate(s) is/are removed and the podule(s) inserted in its/their place(s).

The upper case is provided with ventilation slots on the top and rear and both sides, front and rear.

Additionally if a Winchester Disc Drive or backplane is fitted then a fan must be added to cool the air temperature of the computer. A fan is fitted on the forward LHS using 4 screws to locate and hold.

A filter is supplied and must be cleaned periodically or replaced as required.

The computer/disc drive colour is finished in spark to complement the key-board and monitor (where supplied).

Keyboard Layout

On the top row, left to right, are the "Escape" key and 12 Function keys.

To the right of the Function keys are "Print", "Scroll Lock" and the "Break/ Pause" key. "Print" and "Pause" are not utilised by the operating system. Scroll Lock has a confirmation "ON" LED and may be used to freeze a program listing.

The main keyboard set consists of numeric and alpha keys. These are grouped below the Function keys and are arranged in the standard "QWERTY" configuration. Many of the punctuation symbols are on different keys to those of earlier Acorn products (eg., BBC Model B). The Caps Lock key has a confirmation "ON" LED similar to the Scroll Lock key.

To the right of the main keyboard is a 2 x 3 set of keys providing Insert, Home, Delete, Page Up, Page Down and Copy/End. These can be used to edit program listings. The "Insert" and "End" keys are not utilised by the operating system.

Below this set of six keys are the cursor control keys. These may also be used as editing keys in the same way as previous Acorn machines (eg., BBC Model B).

To the extreme RHS is a standard numeric keypad consisting of 0-9, ".", Enter, "+", "-", "#", "*", "/" and Num Lock. Num Lock has LED confirmation and is used to ensure that 0-9 keys return the ASCII codes. When switched off the keys return various control codes.

The body of the keyboard is Spark finish ABS plastic able to withstand normal knocks.

The base of the body is fitted with five rubber pads to protect any furniture that the keyboard rests on, and minimise keyboard movement.

Keyboard Electronics

A single layer main PCB is utilised to contain the keyswitch actuators and part of the hardware circuitry.

An additional sub PCB contains an EPROM and the balance of the hardware circuitry.

The coiled coupling cable between keyboard and computer is hard wired at the keyboard end to the main PCB and terminated in a mini DIN plug for connection to the computer.

The Mouse accessory is connected to the rear of the keyboard via a mini DIN plug.

A reset switch is provided at the rear of the keyboard for reset of the system. This switch is "push" to make, release to break.

Setting the Real Time Clock

The computer is supplied with a Real Time Clock that is held in battery backed RAM. The following procedure is required to set/adjust the time or date :-

1. Set computer to Basic

2. Input from the keyboard the following line. Ensure that the appropriate length of data is entered for each part and that the correct punctuation or space is left between each part. Complete the entry by pressing the RETURN key.

```
TIME$="Day,Date Month Year.Hours:Minutes:Seconds" (RETURN)
```

3 letters, 3 letters, 2 numerals, 2 numerals

2 numerals, 4 numerals, 2 numerals

To check that the correct time and date is contained in RAM type in :- P.TIME$ The time and date will now be displayed.

This action also controls the "Diary" contained in "Desk Diary" on the Welcome Disc.

If the batteries in the computer are replaced, then the clock will need resetting.

Note : *TIME can be used if preferred to display the date and time.

The Mouse

Referring to Figure 3.3.

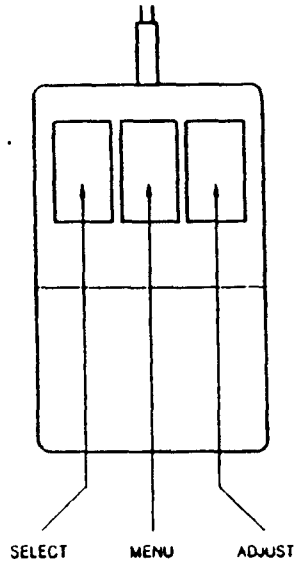


Figure 3.3 The Mouse Control Buttons

2. USING THE WELCOME DISC/GUIDE (PRACTICAL)

Documentation

The Welcome Guide

The Welcome Guide is written for the first time computer user and the experienced computer user.

It has been set out to take the user through setting up procedures and to give a basic explanation of ADFS. The contents summary is given below :-

1. Introduction

2. Setting up the Computer
   Identification of parts and connection

3. Using the Welcome Disc
   Introduction to the Mouse, Wimps

4. Using the Font Designer

5. Formatting and Backing Up
   A brief description is given of what formatting is and does.

6. Configuring for Printers
   How to set up for serial and parallel printers

7. Taking care of your computer
   Advise on do's and dont's
   Cleaning the computer, monitor and keyboard
   How to clean the Mouse
   Battery changing
   Fan Filter changing

8. Floppy Discs
   This chapter describes the build up of a $3\frac{1}{2}$" floppy disc
   How to care for floppy discs
   Write protection
   Use of discs

9. The Keyboard
   The Archimedes keyboard is described in detail and compared to a typewriter keyboard.
   Some keys are described

10. Learning about the 300 Series
    Computer theory in a simple form is described along with some information on the Archimedes computer

Plenty of diagrams are included to assist the reader.

Notes

Section Four
The Archimedes Operating System (Arthur)

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 4 : THE ARCHIMEDES OPERATING SYSTEM (ARTHUR)

CONTENTS

1. ARTHUR

Comparison To Other MOS

Users of existing Acorn computers will find many similarities between existing MOS and the new Archimedes MOS.

*256k bytes of EPROM handling :-

Memory Management
Module Handler
Command Line Interpreter
Keyboard Handler
VDU Drivers
Sound System
Interfacing for RS423, Printers, CMOS RAM Clock
ADFS
ANFS
WIMPs
BASIC V

The MOS is ROM based and ensures that "Cold Start" provides initial values to be set that take the user directly into ARTHUR or BASIC V.

*512k ROM after the first 2000 machines.

Familiarity/Compatability

It is expected that a high percentage of Archimedes users will have had experience of BBC Basic and associated software.

To assist them and ensure as smooth a transfer as possible, the High Level Languages for the machine are directly compatible with the earlier versions. Additionally, a program written in Basic IV will run in Arm Basic V providing no machine code has been implemented.

For machine code programs written on say a BBC B, all that is required is to set up the 6502 Emulator.

Providing that the program is legal, i.e., does not address obscure memory directly, it will run.

See also Aliases.

Appendix A - Minimal Abbreviations
A list of Commands and Abbreviations

Appendix B - Error Messages and Error Number

Appendix C - ASCII and ECMA/ISO Character Codes
Latin 1-2-3-4 Alphabet
Greek Alphabet
BFont Character Codes

Appendix D - Teletext Character Codes

Appendix E - Screen Modes

Appendix F - Inkey Values

Appendix G - Plot Codes

Appendix H - VDU Commands

Appendix I - Operating System Commands

Appendix J - ADFS Commands

Appendix K - *FX Commands

Operating System Commands

Commands	Comments
*CONFIGURE	Sets the CMOS RAM options.
*ECHO	Reflects a string to screen.
*FX	Calls an operating system routine.
*HELP	Gives help on commands, filecommands, modules and syntax.
*IGNORE	Sets the printer ignore character.
*KEY	Defines function keys.
*SET	Assigns a string-type value to a variable.
*SETEVAL	Evaluates an expression and assigns it to a variable.
*SETMACRO	Assigns a macro-type value to a variable.
*SHOW	Lists variables matching a given name.
*STATUS	Displays the CMOS RAM settings, (SEE STATUS TABLE).
*TIME	Displays the current real time.
*TV	Sets the vertical position and interlace.
*UNSET	Deletes a variable.

Further information on these commands can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 2, the USER GUIDE chapter 23 or by using the *HELP option.

Table 4.1

Option.	Default Value.	Other or range of options.	Comments.
Baud	4	(0-8)	RS423 Tx and Rx transmission rates.
BOOT	NOBOOT	NOBOOT	NOBOOT = BOOT's on SHIFT/BREAK only.
			BOOT = BOOT's on POWER ON or CTRL/BRK.
CAPS	CAPS	CAPS	CAPS = Caps Lock on, alpha SHIFT no effect.
		NOCAPS	NOCAPS = Caps Lock off, SHIFT = upper case.
		SHCAPS	SHCAPS = Caps Lock on, SHIFT = lower case.
Data	4	(0-7)	Data format for RS423.
Delay	32	(0-255)	Delay before key auto repeat (in 1/100 sec).
(DIR)ectory	-	(NODIR)ectory	Selects whether ADFS reads directory.
DumpFormat		(0-3)	Sets format of *TYPE report.
File	8	5	Selects filing system, 8=ADFS, 5=ANFS (if fitted).
FontSize	6	(0-255)	Reserves memory for font cache in 4k blocks.
Ignore	10		Printer character ignored, (ASCII code)
Language	3		Module selected at switch on.
Mode	0	(0-20)	Sets default mode.
MonitorType	0		
Print	1	(0-4)	Selects printer driver type.
Quiet	-	Loud	Volume of BELL(Loud=full, Quiet=half).
RamFsSize	0		Reserves memory for RAM filing system in 8k blocks.
Repeat	8	(0-255)	Key repeat rate in 1/100 of a second.
RMASize	2	(0-255) (0 up to 8=64k)	Allocates memory to relocatable module area in 8k blocks over 64k.
Screensize	0	(0-60) (option 0 = 20)	Allocates screen memory in 8k blocks (minimum 24k, maximum 480k).
Scroll	-	NoScroll	Scroll lock ON or OFF.
SpriteSize	1	(0-255)	Allocates memory for sprites in 8k blocks.
Sync	1	(0-1)	Selects separate or composite sync.
SystemSize	0	(0-255)	Reserves space for System Heap in 8k blocks.
TV	255/1		Sets vertical position and interlace.
Drive	0		Drive selected by ADFS at switch on.
Floppies	1	(max of 4)	Number of Floppy Drives on the system.
Harddiscs	0	(max of 4)	Number of Winchesters on the system.
Step	3	(0-3)	Sets drive step rate.
SoundDefault	1 7 1	(0-1) (0-7) (1-16)	Sets sound channel one parameters, speaker, volume, voice.

eg: To reconfigure the Spritesize Area enter...
*CONFIGURE SPRITESIZE n <RETURN> where n is the number of 8kbyte blocks required. Note that a CONTROL/BREAK must be performed for the new value to take effect.

Note: To return to the above default settings, switch the computer off, hold down the R key and switch the computer on again. This may have to be repeated to obtain a locked display. (Depends on the type of monitor in use).

Further information on these commands can be found in the USER GUIDE chapter 9, the PROGRAMMER'S REFERENCE MANUAL chapter 2 (under OSCLI) or by using the *HELP option.

Table 4.2 Default Status Settings

Command Line Interpreter (CLI)

The Command Line Interpreter is a routine that processes commands within the MOS system.

The routine (OSCLI) will skip any * or space characters and check that the command, which is handled as a string, does not exceed 256 characters in length.

A check is made for Aliases and if an Alias is met that it recognises, then the command will be fulfilled. The CLI will then offer the command to any module within the system after the operating system has been requested for validity and an acknowledgement received.

The modules will include the Filing System Manager, which recognises commands such as *DIR. The list of commands for the operating system was covered earlier.

If a comment symbol (|) is observed prior to a command (string) the command will be ignored.

Redirection

The command line interpreter is capable of redirecting information for example typing in the command

*CAT { > FRED } <RETURN>

would catalogue the disc and then create a file called FRED using the catalogue information as data.

To confirm this operation input to the keyboard

*TYPE FRED RETURN

Relocatable Modules

A relocatable module is a piece of software which, when loaded into the machine, can behave as a normal application program or as an extension to the operating system.

Module space is located in the area 24Mbyte-28Mbyte in the 32Mbyte Logically mapped RAM.

Care must be taken that any existing program in RAM is saved or on disc prior to loading a relocatable module as overwriting may occur.

The module space is not guaranteed and therefore a module must be relocatable.

6502 Emulator

The Archimedes has the ability to emulate the 6502 microprocessor and "provides" 32k of user RAM in this mode. The screen is not contained in this memory map but all legal calls to the screen will be routed to the A series screen memory. Page is set at &800.

To use this mode, insert the Welcome Disc and using the keyboard gain access to the 'MODULES' directory.

File 65Arthur is the 6502 emulation program and typing *65Arthur RETURN will allow access.

While in the 6502 mode the enhanced basic commands such as "circle" have no meaning so care must be taken if writing or modifying a program to run in this mode.

Nearly any legal BBC program will run in the 6502 mode providing that no mismanagement of the memory maps has taken place.

Arm BASIC programs do not run in 6502 emulation mode.

To leave the emulator the command *QUIT is required, or Control Break

Floating Point Emulator

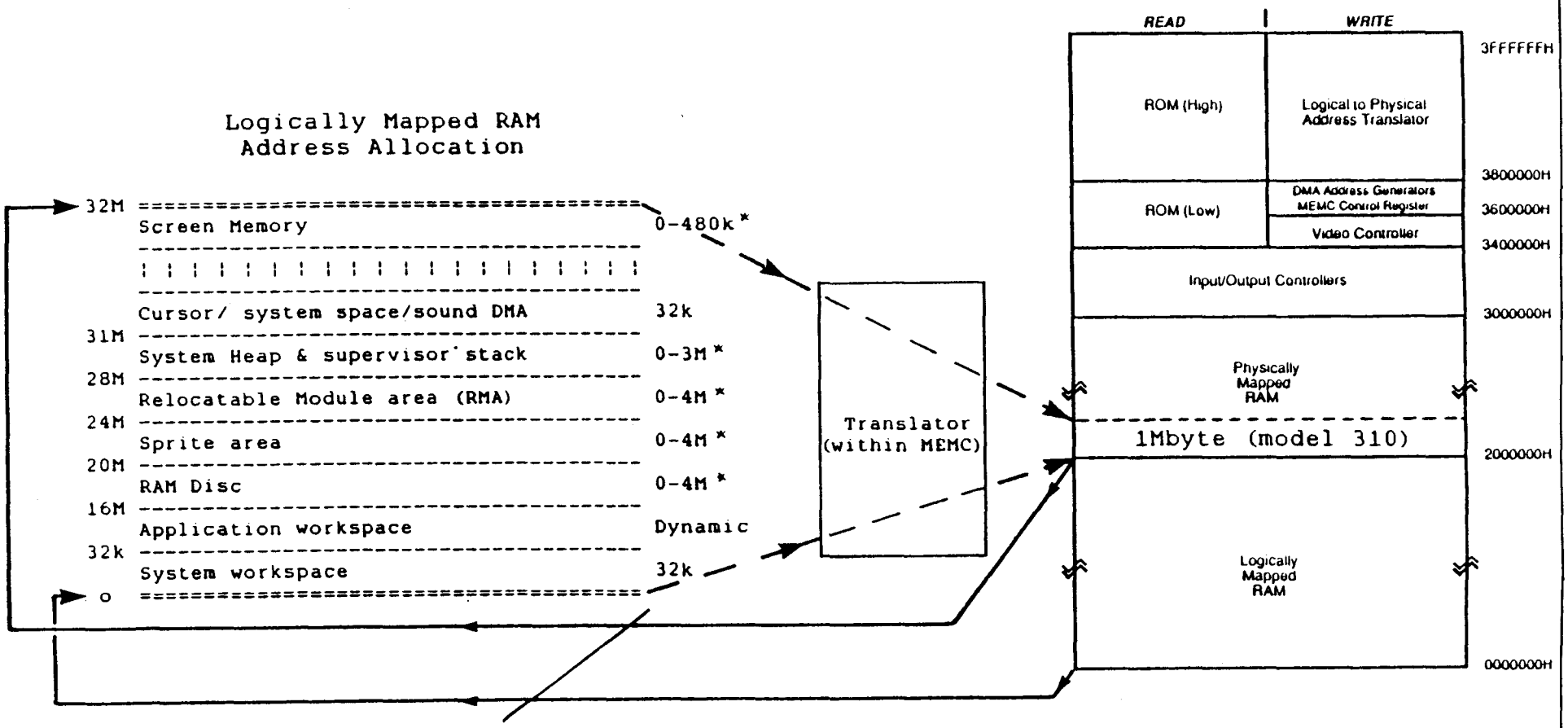
The Acorn RISC machine has a general co-processor interface. The first co-processor envisaged is one which performs floating point calculations to the IEEE standard. To ensure compatability with future versions of the RISC machine which uses this co-processor, the Welcome Disc contains a software floating point emulator which provides all the functionality of a hardware processor. The instructions it provides may be incorporated into any assembler text, provided that they are called from user mode. However, these instructions are not supported by the BASIC assembler.

Precision

All floating point instructions will default to the nearest rounding unless specified within the instruction. The full working precision is 80 bits consisting of a 64 bit mantissa, a 15 bit exponent and a sign bit.

The ARM IEEE floating point system has 8 "high precision" floating point registers F0-F7.

Like the ARM instructions, the floating point data processing operations refer to registers rather than memory locations.



*configured
M = Mbyte

Logical addresses are those used by the programmer to access the physical RAM. The memory map addresses are converted by the Translator within MEMC to the actual addresses required by the physical RAM, (using Page Mode addressing). Whenever the configuration of the machine is changed the Translator is reprogrammed (after a CONTROL/BREAK) to reallocate the memory map addresses to the physical RAM, (see text for a full description).

Figure 4.1 Memory Map And Address Translation.

Location	Default Value
0	Econet station number
1	Econet file server station id (0 and 255 invalid)
2	Econet file server net number (255 invalid)
3	Econet printer server station id (0 and 255 invalid)
4	Econet printer server net number (255 invalid)
5	Default filing system number
6-9	Reserved for Acorn use
10	Bit 0-3 - screen mode number Bit 4 - TV interlace Bits 5-7 - TV vertical adjust (signed three-bit number)
11	Bits 0-2 - unused Bits 3-5 - ShCaps (001), NoCaps (010), Caps (100) Bits 6-7 - unused
12	Keyboard auto-repeat delay
13	Keyboard auto-repeat rate
14	Printer ignore character
15	Bit 0 - unused Bit 1 - 0= Ignore, 1= NoIgnore Bits 2-4 - serial baud rate (0=75...7=19200) Bits 5-7 - printer type
16	Bit 0 - unused Bit 1 - 0= Quiet, 1= Loud Bit 2 - unused Bit 3 - 0= Scroll, 1= NoScroll Bit 4 - 0= NoBoot, 1= Boot Bits 5-7 - serial data format (0..7)
17	ANFS status byte
18-29	Reserved for Acorn use
30-45	Reserved for application programs
46-79	Reserved for the user
80-111	Reserved for Acorn use
112-239	Reserved for operating system software

Mode	Text Col x Row	Resolution Hor x Vert	Logical colours	Memory used
0	80 x 32	640 x 256	2	20k
1	40 x 32	320 x 256	4	20k
2	20 x 32	160 x 256	16	40k
3	80 x 25	Text only	2	40k
4	40 x 32	320 x 256	2	20k
5	20 x 32	160 x 256	4	20k
6	40 x 25	Text only	2	20k
7	40 x 25	TELETEXT	16	80k
8	80 x 32	640 x 256	4	40k
9	40 x 32	320 x 256	16	40k
10	20 x 32	160 x 256	256*	80k
11	80 x 25	Text only	4	40k
12	80 x 32	640 x 256	16	80k
13	40 x 32	320 x 256	256*	80k
14	80 x 25	Text only	16	80k
15	80 x 32	640 x 256	256*	160k
16	132 x 32	Text only	16	132k
17	132 x 25	Text only	16	132k
18+	80 x 64	640 x 512	2	40k
19+	80 x 64	640 x 512	4	80k
20+	80 x 64	640 x 512	16	160k

* COLOUR and GCOL commands can only be used to select from 64 base colours. The full 256 can be obtained via the TINT option. Also the selection from the colour palette of 4096 shades is only possible in groups of 16.

+Modes 18-20 should only be used on multiple scan-rate monitors (for example, NEC Multisync). On conventional monitors these modes do not produce a usable picture.

Further information on screen modes and resolution can be found in the ARCHIMEDES USER GUIDE chapters 10,11,12 and 14.

Table 4.6 Screen Modes And Resolution

2. REPLACEMENT OF ROMS (UPGRADING)

Replacement of EPROMS

Referring to Figure 4.2.

The first 2000 machines will be fitted with an EPROM set to provide ARTHUR. Eventually the end user may wish to replace these with a ROM set.

The 4 x ROM sockets provided are 32 pin DIL and the chips used are 28 pin DIL.

Care must be taken to ensure that the ROMs are fitted in the **FORWARD** 28 pins and that the rear 4 pins are vacant.

If a Podule backplane is fitted then it must be removed prior to any ROM IC removal/function. Failure to do so could cause irrepairable damage to the PCB.

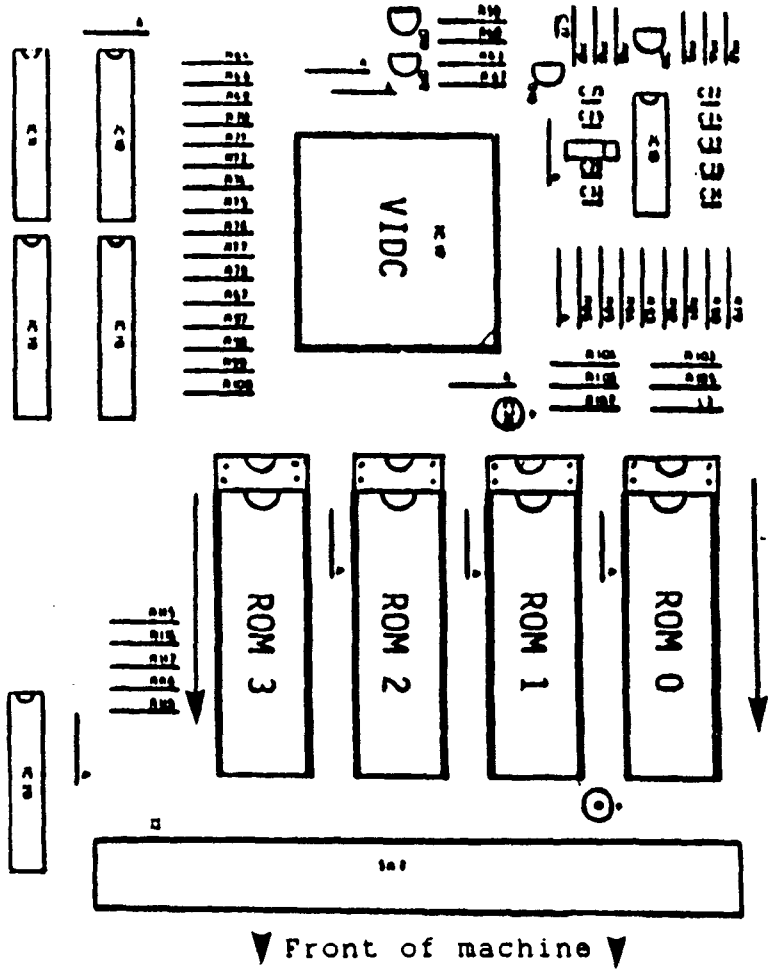


Figure 4.2 EPROM Replacement

Section Five
ADFS and ANFS (Econet)

Notes

Notes

Screen Modes

The display produced on a standard monitor can be in any o 18 different modes. These are referred to by numbers from zero to 17.

Each mode gives a different combination of values to the following four items:-

* the number of characters you can display on the screen
* the graphics resolution
* the number of colours available on the screen at any one time
* The amount of memory allocated to the screen display

For example, mode 0 allows 32 rows of text to be displayed, each containing up to 80 characters. It provides high resolution graphics but allows just two colours to be displayed on the screen. In contrast mode 1 can display just 40 characters on a row and provides medium resolution graphics. However, it supports up to four colours. Different modes use different amounts of memory to hold the picture. The amount of memory is determined by the resolution and by the number of colours. Mode 0 for example, requires 20K.

The mode which uses the most memory is the one with the highest resolution and the highest number of colours available. This is mode 15 which combines the highest resolution with the facility to use all 256 colours at once.

To change mode, type MODE followed by the mode number you want. For example MODE 12 changes the display to mode 12. This is one of the most useful modes since it provides high resolution graphics in 16 colours. For example, x screens are available in mode and can be switched between for smooth animation.

Once the Physical page address has been determined a selected number of the ARM address lines is multiplexed with the page address to give the absolute location address.

Note that the operator always uses the Logical Addresses to access the Physical RAM. In this example there are 32 Mbytes of Logical Address and only 1Mbyte of actual memory, therefore, many of the Logical addresses cannot be translated into Physical addresses.

Protection Modes

Three levels of protection are built into the MEMC to ensure that only allowable addressing takes place. So, when a logical page is accessed, the logical to physical translator tries to convert the logical page number to a physical page number. Providing that the page has already been reserved in the conversion table then translation can take place and data can be transferred.

If the translation is invalid MEMC will terminate the translation with an "abort" signal and display an appropriate error message.

The protection modes are :-

i) Supervisor Mode
Supervisor Mode is selected while the SPVMD input is held HIGH. This is the most privileged mode, allowing the entire memory map to be freely accessed.

ii) Operating System Mode (OS Mode)
OS mode is selected by setting a control bit in the MEMC Control Register (which may only be done from Supervisor mode). OS mode is more privileged than User mode when accessing Logically Mapped RAM, but acts like User mode in all other cases.

iii) User Mode
User mode is the least privileged of the three protection modes. Unprotected pages in the Logically Mapped RAM may be accessed when in User mode, and the ROM space may be read, but no other accesses are allowed.

All attempts to access protected addresses from an insufficiently privileged mode (User mode or OS mode) will activate the ABORT line without performing the access.

Non-volatile Memory

240 bytes of non-volatile memory are provided. Some of these are reserved since they hold default values for certain parameters. The full list is given below.

Values may be stored into ARM memory in :-

IEEE Single Precision
IEEE Double Precision
Double Extended Precision
Packed Decimal

There is a floating Point Status Register (FPSR) which like ARMs. PSR and PC has all the status for the floating point system. The FPSR contains the IEEE flags.

Further information and a detailed explanation are to be found in the Programer's Reference Manual.

Memory Mapping

Referring to Figure 4.1.

The Memory map in the Archimedes supports up to 64 megabytes. However, the actual RAM supported by the Archimedes RISC chip set is limited to 4Mbytes by the MEMC.

In the 305 and 310 machines the actual physical RAM fitted is limited to 0.5Mbytes and 1.0Mbyte respectively.

To read or write data, the address created by the processor (known as the Logical Address) must be converted into a Physical Address used by the actual RAM fitted. The conversion is carried out by a Logical to Physical Address Translator built into the MEMC.

To carry out this conversion, page mode addressing is used. The size of the page is determined by the size of the actual RAM fitted. The number of pages is fixed at 128, so for the 1.0Mbyte machine the number of bytes per page is equal to $\frac{1.0\text{Mbyte}}{128}$ or 8kbytes.

The addresses in Logical RAM are also split up in pages of 8kbytes. The number of pages of Logical RAM is equal to $\frac{32\text{Mbytes}}{8\text{kbytes}}$ or 4096.

It is the job of the Translator to convert the Logical page into a Physical page.

The start address for the various RAM areas are shown in Figure 4.1.

If 16kbytes of RAM is required to hold, say the sprite definitions, then two 8kbyte pages must be reserved. This is done by the operator using the *Configure SPRITESIZE command. Once configured and after pressing CONTROL and BREAK, a conversion table of Logical to Physical Addresses is set up within the MEMC. In the above example two Logical pages starting at address 20Mbyte would be translated into two Physical pages within actual physical RAM.

Commands	Comments.
*MODULES	Lists system and relocatable modules currently in the machine.
*RMCLEAR	Deletes all relocatable modules.
*RMKILL	Deletes individual module.
*RMLOAD	Loads and initialises module.
*RMREINIT	Reinitialises module already in the machine.
*RMRUN	Runs module.
*RMTIDY	Compacts workspace.

Further information on these commands can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 5 or by using the *HELP optior

Table 4.4 Relocatable Module Commands

Machine Code Debugger *Commands

The operating system contains a machine code debugger which allows breakpoints to be set so that a piece of code will stop when it reaches a particular instruction. Other commands may then be called to interrogate and even reset the values contained at particular addresses in memory and to list the contents of the registers. Then execution of the code may be continued from that point. The debugger is on the welcome disc for the first 2000 machines and can be loaded with the command :-

*RMLOAD $.MODULES.DEBUGGER

Commands	Comments.
*BREAKCLR	Removes breakpoint.
*BREAKLIST	Lists currently set breakpoints.
*BREAKSET	Sets a breakpoint at a given address.
*CONTINUE	Start execution from a breakpoint saved status.
*DEBUG	Enter the debugger.
*INITSTORE	Fill memory with given data.
*MEMORY	Display memory between two addresses or registers.
*MEMORYA	Display and alter memory.
*MEMORYI	Disassemble ARM instructions.
*QUIT	Exit the debugger.
*SHOWREGS	Display registers caught by traps.

eg: *BREAKSET <address> <RETURN> sets a breakpoint at the address given so that when the code is executed and the instruction at that address is reached execution will be halted so that the values held in various addresses or registers may be checked, altered etc.

An explaination of these commands and their use can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 4.

Table 4.5 Debug Commands

Sprite * Commands

Commands.	Comments.
*SSAVE	Saves the sprite memory.
*SLOAD	Loads a sprite file into memory.
*SMERGE	Appends a sprite file to those in memory.
*SCREENLOAD	Loads a sprite from a file into the graphics window.
*SCREENSAVE	Saves the graphics window as a sprite file.
*SGET	Picks up an area of screen as a sprite.
*SCHOOSE	Selects a sprite.
*SCOPY	Makes a copy of a sprite.
*SRENAME	Renames a sprite.
*SLIST	Lists all the sprites in memory.
*SFLIPX	Reflects a sprite about the x axis.
*SFLIPY	Reflects a sprite about the y axis.
*SNEW	Clears all sprite definitions.
*SDELETE	Deletes named sprites.
*SINFO	Prints the size of the sprite workspace.

eg: Entering *SSAVE <name> <RETURN> will save all the sprites currently in memory to a file which can later be reloaded.

*CONFIGURE SPRITESIZE 'n' allocates memory to sprites in 'n' x 8k blocks.

Further information on these commands can be found in the USER GUIDE chapter 13, the PROGRAMMER'S REFERENCE MANUAL chapter 7 or by using the *HELP option.

Table 4.3 Sprite Commands

A Sprite Editor is included as a utility on the Welcome Disc and makes the creation of sprites far easier. Chapter 13 of the User Guide gives a full description of the Sprite Editor and its uses.

Window Manager

The Window Manager has been designed to simplify the task of producing application programs to run under a 'WIMP' (Windows, Icons, Mice and Pop-up menus) environment.

The Window Manager co-operates with the application in keeping the screen correct by telling the applications when something needs to be redrawn. Thus, the application needs to make as few intelligent decisions as possible - it merely has to respond approximately to messages it receives from the window manager, in addition to performing its own processing (using the routines supplied to perform window operations).

The desktop program on the Welcome Disc (in ROM after first 2000 machines) is a good example of the power of the Window Manager and a description of how to make use of its facilities is given in Chapter 7, Section 4, of the Progammers Reference Manual.

Configuration/Status

Referring to Figure 4.2.

The machine comes on in a default status condition as shown in Figure 4.2. Status commands can be reconfigured if required by selecting the relevant command and altering its value.

For example, DRIVE 0 is the resident Floppy disc drive but the command option could be changed to 1 which would be the resident Winchester disc drive (where fitted). To reconfigure the status, type :-

*CON. FLOPPIES 4 <RETURN>

Holding down CONTROL and pressing and releasing BREAK will write the new values into the battery backed RAM.

*STATUS will list all of the status commands and their values.

Archimedes has a default value reset routine built in to reset all values back to default. This is run by holding down button 'R' and turning the machine off and back on ONCE for a dual sync monitor or holding down the 'R' button and turning the machine off and on TWICE for a standard sync monitor.

Aliases

It is possible to change the names of * commands. These new names, or aliases, can then provide a familiar environent for users transferring from a different operating system.

The alias is created using the command :-

*SET ALIAS$<new name> <command>

(brackets for clarity, not required)

For example, the ADFS command *VERIFY is equivalent to the DOS command COMP. To change the *VERIFY to *COMP type :-

*SET ALIAS$COMP VERIFY

These Aliases are only valid until control break is pressed.

The User Guide

The book takes the format of other Acorn computer publications and consists of 25 chapters and 11 appendices. Prior to the contents is a page on Safety and Do's and Don'ts.

Chapter :-

1) Short Introduction

2-8) Introduction to "Basic"

9) About the Filing System and ADFS and ANFS

10) Screen Modes
Discussions and examples of the screen modes available (up to 18 modes)
Discussion and examples of colour

11) Graphics
Discussion of graphics modes and new commands

12) Windows
Text and Graphic windows are discussed with example programs

13) Sprites
This chapter discusses sprites and how to define them.
Sprite commands are covered and Sprite Plotting

14) Teletext Mode

15) Sound

16) Keyboard, Mouse and Function Keys

17) Indirection Operators

18) Bases

19) Connection and use of a printer

20) Error Handling and Debugging

21) Basic Keywords and Syntax
(Typing Help . will list the keywords)
Several new Basic keywords are included

22) VDU Commands

23) Operating System Commands

24) *FX Commands

25) Basic Screen Editor
Discussion is made on entering the editor, edit screen, etc., Edit keys, Error Messages

The Mouse accessory supplied with the system will allow access to a range of WIMP programs such as Desk Top.

The Mouse has a 3 key function set.

The Mouse position data and commands are passed to the keyboard via a 9 wire lead approximately 2/3 metre in length. The lead is terminated at the end for keyboard connection with a 9 pin mini DIN plug.

The Mouse position is relayed to the computer via a nylon roller ball which rotates two slotted discs set at 90° to each other. Each disc interrupts the path of an infra-red beam in an optocoupler. One disc represents the 'X' axis and the other represents the 'Y' axis. The computer uses pulse counting techniques to determine the position of the pointer on the screen.

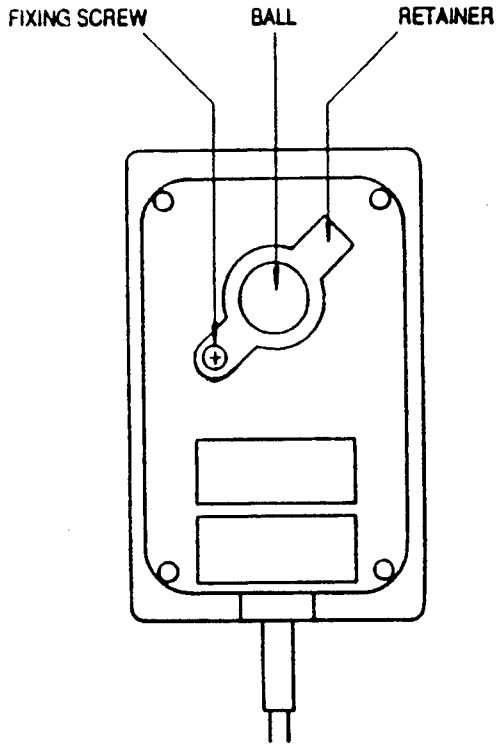


Figure 3.4 Mouse Base View

Referring to Figure 3.4.

The ball should be removed periodically for cleaning and checking for damage.

This is catered for by a ball retainer on the base of the Mouse. Ball tension is applied via a cantilever assembly within the Mouse.

Key		INKEY number
f0		-33
f1		-114
f2		-115
f3		-116
f4		-21
f5		-117
f6		-118
f7		-23
f8		-119
f9		-120
f10		-31
f11		-29
f12		-30
A		-66
B		-101
C		-83
D		-51
E		-35
F		-68
G		-84
H		-85
I		-38
J		-70
K		-71
L		-87
M		-102
N		-86
O		-55
P		-56
Q		-17
R		-52
S		-82
T		-36
U		-54
V		-100
W		-34
X		-67
Y		-69
Z		-98
0		-40
1		-49
2		-50
3		-18
4		-19
5		-20
6		-53
7		-37
8		-22
9		-39
,		-103
-		-24
.		-104
/		-105
|		-57
\		-121
]		-89
;		-88

Key		INKEY number
Esc		-113
Tab		-97
Caps Lock		-65
Scroll Lock		-32
Num Lock		-78
Break		-45
Back Tick/~		-46
£/Currency		-47
Back Space		-48
Insert		-62
Home		-63
Page Up		-64
Page Down		-79
'/'		-80
Shift	(either/both)	-1
Ctrl	(either/both)	-2
Alt	(either/both)	-3
Shift	(left-hand)	-4
Ctrl	(left-hand)	-5
Alt	(left-hand)	-6
Shift	(right-hand)	-7
Ctrl	(right-hand)	-8
Alt	(right-hand)	-9
Space Bar		-99
Delete		-90
←		-74
Copy		-106
↑		-58
←		-26
→		-122
↓		-42
Keypad 0		-107
Keypad 1		-108
Keypad 2		-125
Keypad 3		-109
Keypad 4		-123
Keypad 5		-124
Keypad 6		-27
Keypad 7		-28
Keypad 8		-43
Keypad 9		-44
Keypad +		-59
Keypad -		-60
Keypad .		-77
Keypad /		-75
Keypad #		-91
Keypad *		-92
Keypad ←		-61
Select		-10
Menu		-11
Adjust		-12

Table 3.1 Keyboard Inkey Values

ASCII Code Tables

ASCII code tables shown in User Guide pages 434-440.

Power

Mains power leads are supplied for the VDU and the computer/disc drive.

Fuse rating for the VDU colour monitor is 5A (where separate lead supplied and fitted).

Fuse rating for the computer/disc drive is 3A.

Both fuses are standard 1" powder filled to BS1362.

Any replacement fuse must be of the same rating and type.

Mains plugs are moulded to the power cable with access to the fuse via a carrier in the pin side.

Keyboard

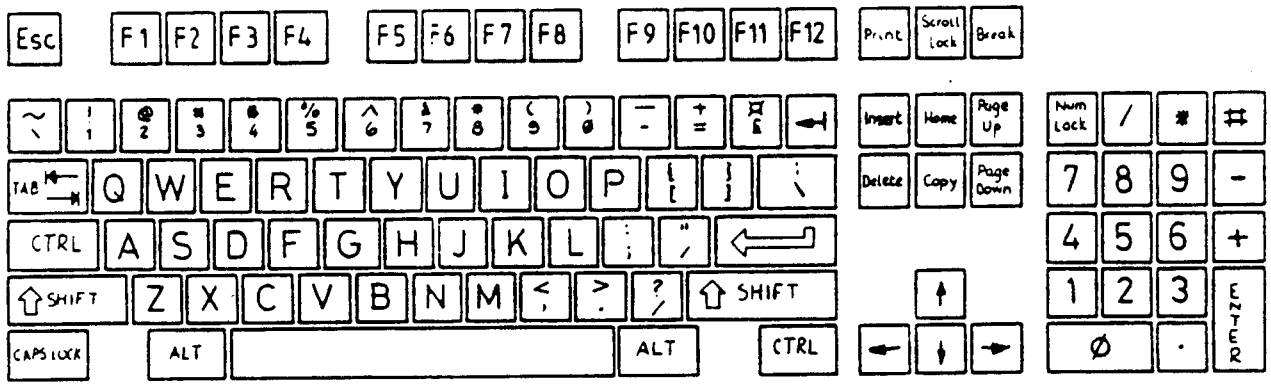


Figure 3.2 Keyboard Layout

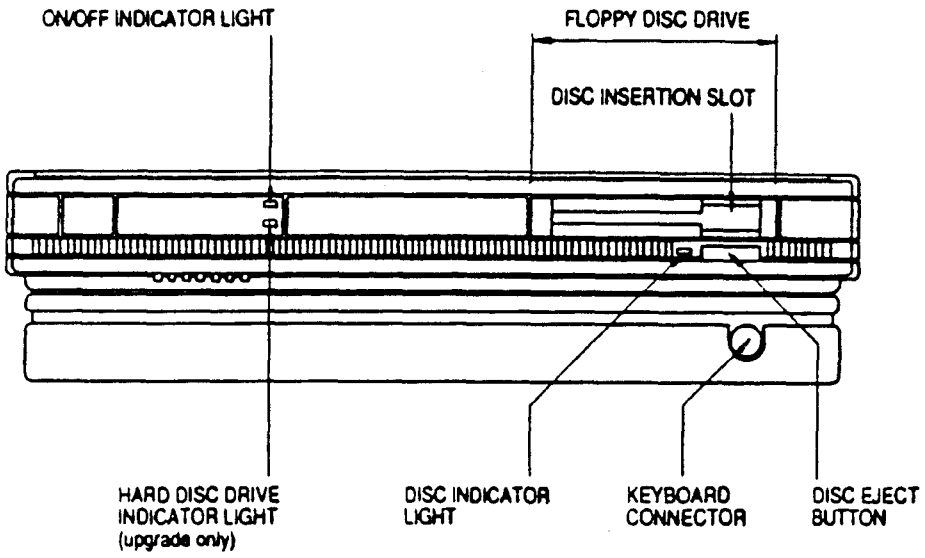
Referring to Figure 3.2.

The keys are "scalloped" soft touch, with the actuator design having a degree of tactile feedback.

The BBC badged machines have the Function keys in red.

The Acorn badged machines have the Function keys in grey.

Front



Back

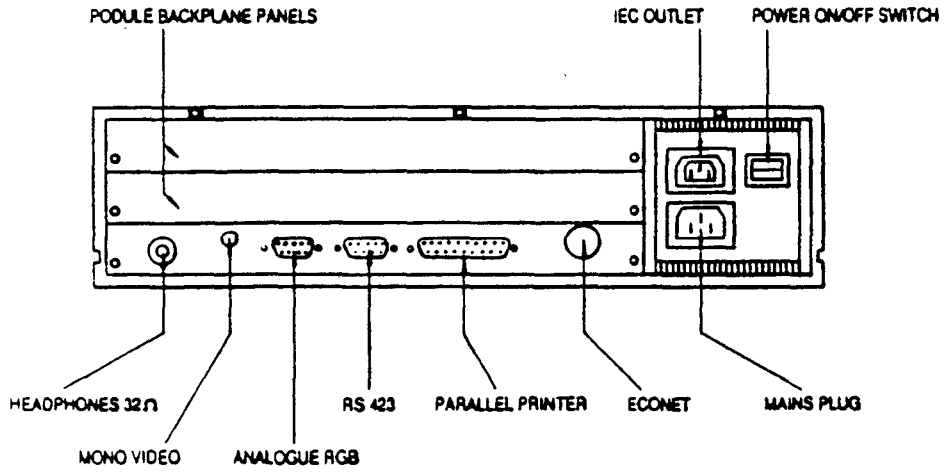


Figure 3.1 Computer Indicators/Input/Output Connectors

Interfaces

Referring to Figure 2.3.

Input/Output	Connector Type	Application.
Headphones	3.5mm Jack SKT	For driving headphones (32ohms) - Stereo, can also drive the monitor speaker.
Mono Video	Phono socket	Provides composite mono signal 1V Peak to peak.
RGB Out	9 way 'D' SKT	Provides analogue RGB, sync and blanking.
RS423	9 way 'D' plug	Serial data IN/OUT.
Printer	25 way 'D' SKT	Parallel Printer Port.
Econet	5 pin 180 DIN	To provide connection to Econet system. (requires additional plug-in module).

Note that the RGB, RS423 and Printer sockets are **not** the same as earlier Acorn machines.

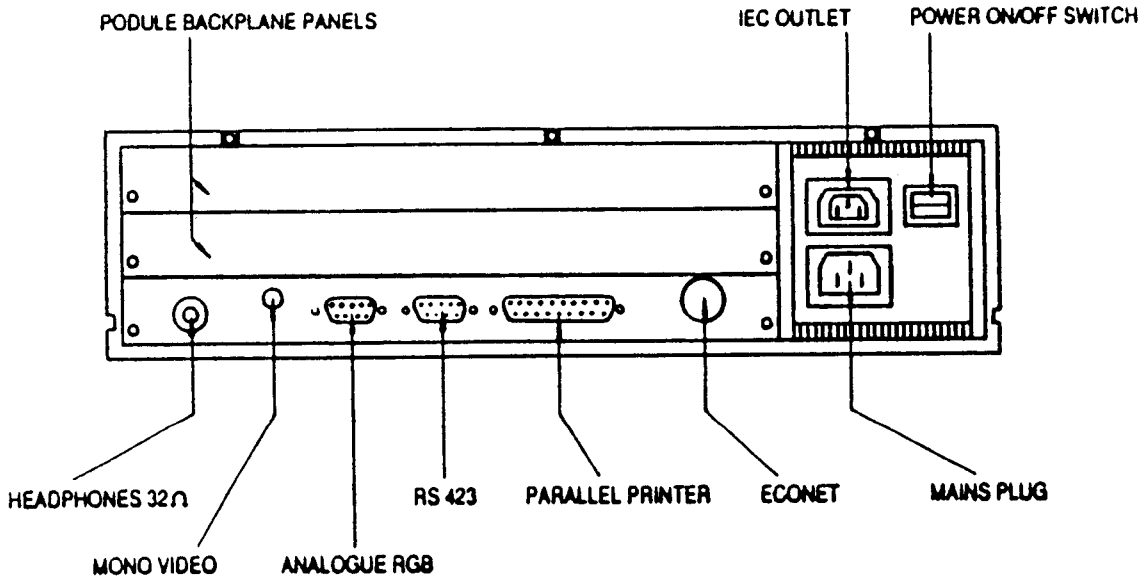


Figure 2.3 Interfaces/Rear Connectors

Safety

As with any electronic equipment care should be taken if any item is being fitted or removed, either internally or externally to Archimedes. The machine should always be turned off and disconnected and a few seconds allowed to pass prior to work commencing. Failure to do so could result in damage to the machine.

The podule interface consists of a 64 way DIN 41612ac connector. It is defined as follows :-

pin	a	c	
1	0V	0V	ground
2	LA[15]	-5V	supply
3	LA[14]	0V	ground
4	LA[13]	0V	ground
5	LA[12]	*reserved*	
6	LA[11]	$\overline{MS}$	MEMC Podule select
7	LA[10]	*reserved*	
8	LA[9]	*reserved*	
9	LA[8]	*reserved*	
10	LA[7]	*reserved*	
11	LA[6]	*reserved*	
12	LA[5]	$\overline{RST}$	reset see note
13	LA[4]	PR/$\overline{W}$	read / not write
14	LA[3]	$\overline{PWE}$	write strobe
15	LA[2]	$\overline{PRE}$	read strobe
16	BD[15]	$\overline{PIRQ}$	normal interrupt
17	BD[14]	$\overline{PFIQ}$	fast interrupt
18	BD[13]	*reserved*	
19	BD[12]	C1	I^2C serial bus clock
20	BD[11]	C0	I^2C serial bus data
21	BD[10]	$\overline{EXTPS}$	External Podule select
22	BD[9]	$\overline{PS}$	Simple Podule select
23	BD[8]	$\overline{IOGT}$	MEMC Podule handshake
24	BD[7]	$\overline{IORQ}$	MEMC Podule request
25	BD[6]	$\overline{BL}$	I/O data latch control
26	BD[5]	0V	Supply
27	BD[4]	CLK2	2MHz synchronous clock
28	BD[3]	CLK8	8MHz synchronous clock
29	BD[2]	REF8M	8MHz reference clock
30	BD[1]	+5V	supply
31	BD[0]	*reserved*	
32	+5V	+12V	supply

The *reserved* pins must be left unused as in some machines these pins carry coprocessor signals.

Table 2.3 Simple Podule and MEMC Podule Interface

Note : The $\overline{RST}$ wsignal is the system reset signal driven by IOC on power-up or by the keyboard reset switch. It is an open-collector signal, and podules may drive it also if this is desirable. The pulse width should be at least 50ms.

A Coprocessor can be interfaced to the machine providing access to the full data bus directly.

The Coprocessor interface is identical to the normal Podule interface except that row 'b' is loaded with the system data bus and that most of the "reserved" pins of row 'c' are allocated.

The Podule data bus is 16 bits (2 bytes) wide allowing single bytes or half word access.

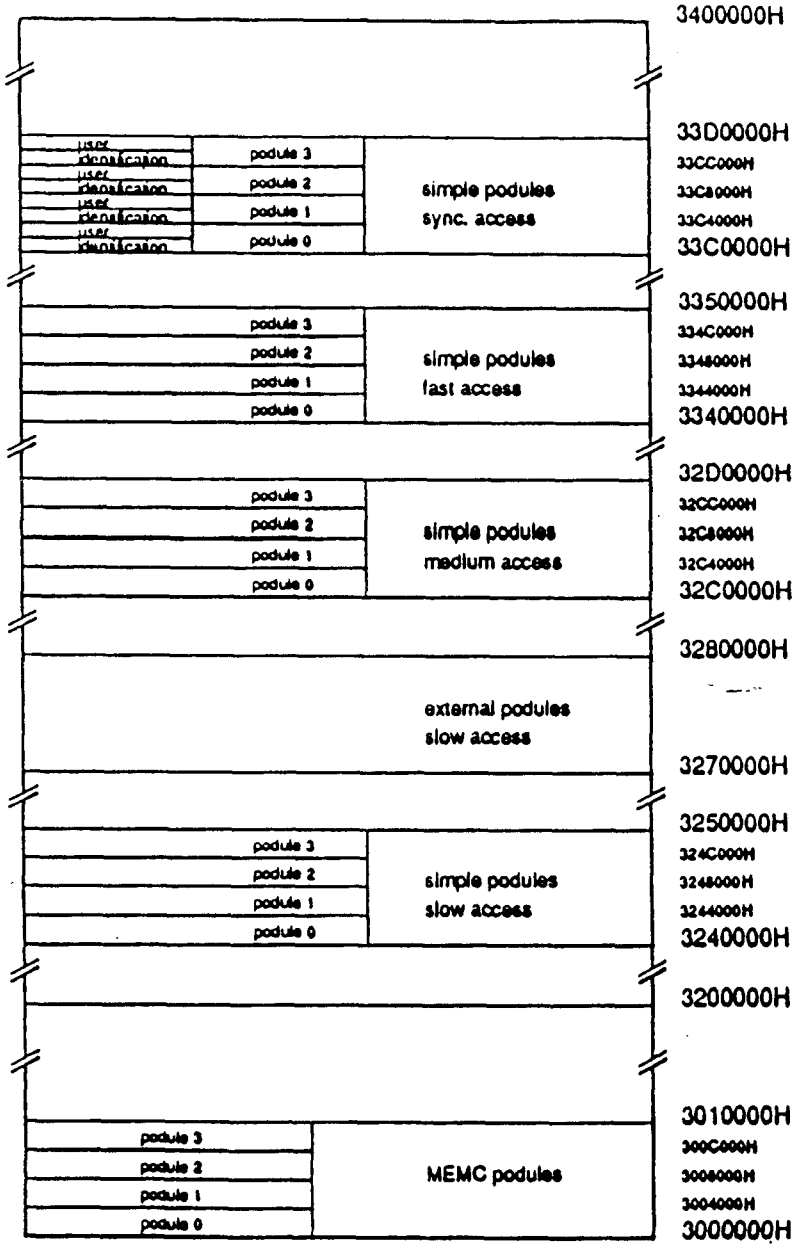


Figure 2.2 Podule Interfacing Expanded Memory Map

MEMC Podules

These podules attach directly to the MEMC $\overline{\text{IORQ}}/\overline{\text{IOGT}}$ interface, and occupy the non-IOC address space. Each of these podules can occupy up to 8kbytes of address space. The cycle timing of these podules must be determined by a state machine on the podule. Sometimes a podule of this category also appears as a Simple Podule, with the "Simple Podule" mapping used for control, and the "MEMC Podule" mapping used for data transfer, but care has to be taken in this case as the two types of interface are effectively synchronous.

Coprocessor Podules

Coprocessor Podules share the same interface as other podules, but they are not mapped into the I/O space as are other podules. In addition to the normal podule signals, coprocessors require access to the main system data bus, and extra control signals. These are provided by the addition of B row in the I/O expansion connector. When a coprocessor is not required, this connector may be used a a normal podule slot. Note that in this context the term "coprocessor" refers to a dedicated hardware processor, and not an additional general purpose microprocessor system. This class of podule is only briefly referred to in this document.

External Podules

Up to four podule slots are provided in present machines. If this is insufficient, or a podule is required to be larger than the space provided, then an external podule (or podules) can be fitted. One of the four normal podule slots must be a buffer podule to buffer all the signals on the podule bus before they exit from the machine. External podules can then be fitted to the buffered podule bus. External podules have a 32kbyte address space allocated to them by the IOC.

Podule Interfacing

Referring to Figures 2-1 and 2-2.

Podule addressing ranges from 3000000H to 3400000H, giving workspace of four megabytes.

Languages

* Many foreign alphabets included as standard, B Font, Latin, 1, 2, 3, 4, Greek

* Arabic, Cyrillic, Hebrew, etc., planned as options.

* Different keycaps and layouts can be provided.

Video Lead

Length : As for ADF32 lead
Colour : Cream or White
Monitor end connector : SCART plug
Computer end connector : 9 pin D-type plug

Connections : Signal	D-type	Scart	Lead
RED	1	15	75 ohm co-ax
GREEN	2	11	75 ohm co-ax
BLUE	3	7	75 ohm co-ax
CSYNC*	4	20	75 ohm co-ax
N/C**	5	N/C	
0V	6	13	
0V	7	9	
0V	8	5	
0V	9	21	

* - Link option for HSYNC on computer
** - Link option for VSYNC or Mono Comp Video on computer

Features.	Models			
	BBC Badged		Acorn Badged	
	A305	A310	A410	A440
RAM.	0.5MByte Expandable to 1MByte	1.0MByte	1.0MByte Expandable to 4MByte	4.0MByte
ROM.	0.5MByte (256k EPROM preproduction)	0.5MByte (256k EPROM preproduction)	0.5MByte plus extra firmware	0.5MByte plus extra firmware
DISC.	*1MByte Floppy (unformatted) An extra Floppy or a 20MByte Winchester can be added.	*1MByte Floppy (unformatted) An extra Floppy or a 20MByte Winchester can be added.	*1MByte Floppy (unformatted) Winchester controller fitted. Extra Floppy or 20MByte Winchester can be added.	*1MByte Floppy (unformatted) 20MByte Winchester
BACKPLANE	2 Podule backplane plus fan optional extra.	2 Podule backplane plus fan optional extra.	4 socket backplane plus fan fitted as standard.	4 socket backplane plus fan fitted as standard.
Co-Processor	N/A	N/A	Co-Processor #(FPU) bus.	Co-Processor #(FPU) bus.
MONITOR	4 Monitor options 1. None 2. Mono 256 lines Analogue. 3. Colour 256 lines Analogue RGB. 4. Colour 256/512 lines Analogue RGB Multisync.		1. None 2. Mono 256 lines Analogue 3. Colour 256 lines Analogue RGB. 4. Colour 256/512 lines Analogue RGB Multisync.	
KEYBOARD	Function keys in red.		Function keys in grey.	
MOUSE	3 key operation.		3 key operation.	

* 800k when formatted using *FORMAT <Drive Number> D
  640k when formatted using *FORMAT <Drive Number> L (Master/Compact compatible)

FPU = Floating Point.

Table 2.1 Models

Code	Comments
AL	Always carry out instruction irrespective of the condition code.
CC	Carry clear.
CS	Carry set.
EQ	Equal.
GE	Greater than or equal to.
GT	Greater than.
HI	Higher (unsigned).
LE	Less than or equal to.
LS	Lower or same.
LT	Less than.
MI	Negative (minus).
NE	Not equal.
NV	Never (instruction not executed - NOP).
PL	Positive.
VC	Overflow clear.
VS	Overflow set.

Note: Two of these may be given alternative names as follows:

LO Lower unsigned is equivalent to CC.
HS Higher/Same unsigned is equivalent to CS.

Code	Comments
ASL	Arithmetic shift left.
LSL	Logical shift left.
ASR	Arithmetic shift right.
LSR	Logical shift right.
ROR	Rotate right.
RRX	Rotate right one bit with extend.
ADC	Add with carry.
ADD	Add without carry.
SBC	Subtract with carry.
SUB	Subtract without carry.
RSC	Reverse subtract with carry.
RSB	Reverse subtract without carry.
AND	Bitwise AND.
BIC	Bitwise AND NOT.
ORR	Bitwise OR.
EOR	Bitwise EOR.
MOV	Move.
MVN	Move NOT.
CMN	Compare negated.
CMP	Compare.
TEQ	Test equal.
TST	Test.
MUL	Multiply.
MLA	Multiply and accumulate.
B	Branch.
BL	Branch and link.
LDR	Load register.
STR	Store register.
LDM	Load multiple registers.
STM	Store multiple registers.

Further information on these commands and their use can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 4.

ARM Instruction Set

The IOC IC

The Input Output Controller (IOC) is a member of the Acorn RISC Machine (ARM) support chip set, and interfaces directly with the Memory Controller (MEMC) and the Video Controller (VIDC) to provide a unified view of interrupts and peripherals within an ARM based system. IOC manages an 8 to 32 bit IO data bus to which peripheral controllers may be connected, provides a set of internal functions, and controls the access cycles to the external peripherals.

The internal functions include timers, a serial keyboard interface, and interrupt control logic to satisfy the basic requirements of a computer system. The peripheral timing cycles allow standard peripheral controllers from a wide range of manufacturers to be interfaced without any additional logic. A flexible control port offers a number of general purpose input/output pins.

Features

* Power-on Reset Control
* 4 independent 16 bit programmable counters
* Bidirectional serial keyboard interface
* 6 Programmable bi-directional control pins
* Interrupt mask, request and status registers for $\overline{IRQ}$ and $\overline{FIQ}$
* 14 level-triggered interrupt inputs
* 2 edge-triggered interrupt inputs
* 4 programmable peripheral cycles
* 7 external peripheral selects
* ARM/IO bus interface control
* Expansion bus buffer control
* Fabricated in CMOS for low power consumption

The MEMC IC

The Memory Controller (MEMC) acts as the interface between the ARM (Acorn RISC Machine) processor, Video Controller (VIDC), I/O Controllers (including IOC), Read-Only memories (ROM) and Dynamic memory devices (DRAM), providing all the critical system timing signals.

Up to 4MBytes of DRAM may be connected to MEMC, which provides all signals and refers operations for a wide variety of standard DRAMs. A Logical to Physical Address Translator maps the Physical memory into a 32MByte Logical address space (with three levels of protection) allowing Virtual Memory and Multi-Tasking operations to be implemented. Fast "page mode" DRAM accesses are used to maximise memory bandwidth.

MEMC supports Direct Memory Access (DMA) read operations with a set of programmable DMA Address Generators, which provide a circular buffer for Video data, a linear buffer for Cursor data, and multiple buffers for Sound data.

Features

* Acts as the interface between the ARM processor, Video Controller, I/O Controllers, Read only memories and Dynamic memory devices
* Directly drives standard Dynamic RAMs
* Provides refresh for DRAMs
* Supports up to 4MBytes of real memory
* Logical to Physical address translation
* Three protection levels supported
* Uses fast "Page mode" DRAM accesses to maximise memory bandwidth
* Internal DMA address generators for Video, Cursor and Sound data buffers
* Arbitrates memory between the processor and DMA
* Many ROM speeds supported
* Provides all critical system timing signals, including processor clocks
* Fabricated in CMOS for low power

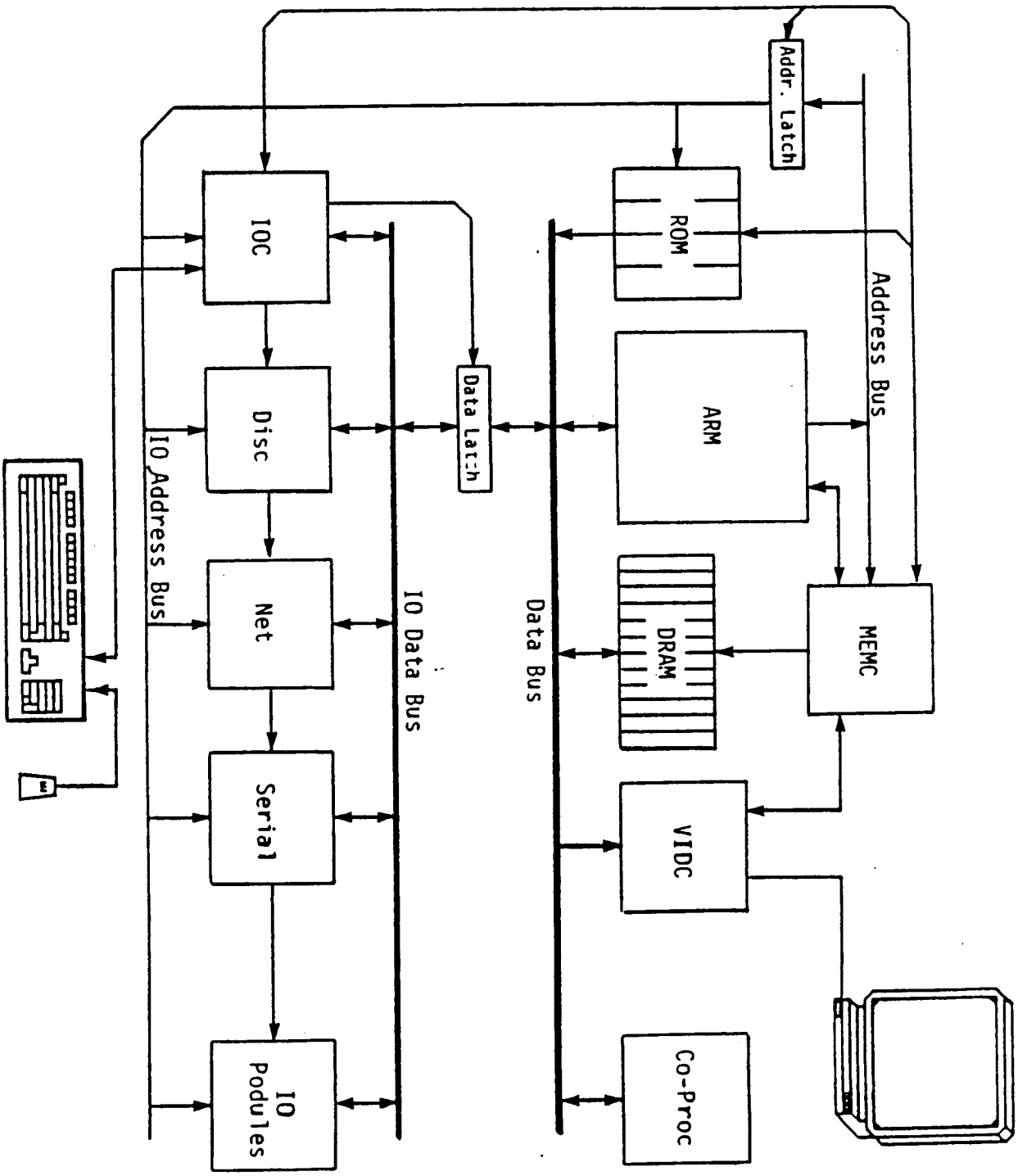


Figure 1.1 Archimedes Basic Block Diagram.

3. THE RISC FAMILY

Introduction

The Archimedes series uses the Acorn RISC Machine or ARM microprocessor. Supporting the microprocessor are :-

1. The Memory Controller (MEMC)
2. The Video Controller (VIDC)
3. The Input/Output Controller (IOC)

The memory controller is the interface between the ARM processor, Video Controller (VIDC), I/O Controllers (including IOC), Read Only Memories (ROM) and Dynamic Memory (DRAM). It provides all the critical system timing signals.

The Video Controller controls the output to the screen and also contains the sound generator.

The Input/Output Controller provides a unified view of interrupts and peripherals within the ARM based system.

Figure 1.1 overleaf illustrates how the RISC chip set are interconnected in the Archimedes series of machines, with Figure 1.2 showing the practical layout of the 300 series PCB.

A description of the main features of each of these devices starts on page 1-3-4.

Barrel Shift

An additional feature of the RISC processor is the use of a "Barrel Shifter". This is a 32 bit shift register which is capable of shifting data left or right by any number of locations in one clock period.

Thus a rotate left by 6 bits can be performed in one clock cycle instead of 6 cycles. This can be used to speed up a multiplication instruction to approach that of, say, the "Add" instruction.

Registers

The processor contains 27 registers, each 32 bits wide. Only 16 of these can be seen by the programmer.

The procesor can operate in four different modes :-

1. User
2. Supervisor
3. Interrupt
4. Fast Interrupt

Some of the user registers are exchanged for some of the additional 11 registers in different modes. This obviates the need to save registers on the stack or in the memory.

Memory

The processor is a word addressed 32 bit device using a 26 bit address bus. This allows, in theory, up to 64Mb of memory to be accessed.

Data Bus

The data bus is 32 bits wide and can be treated as an 8 bit byte or a 32 bit word.

Interesting Data

* 27 Registers (each 32 bits)
* Contains 25,000 transistors (the Motorola 68020 contains 192,000 transistors)
* Runs at approximately 4Mips
* Uses 2uM technology
* RISC BASIC can operate faster than some machine codes
* Able to address up to 64Mbs
* Same chip area as the 6502

2. INTRODUCTION TO RISC

History Of Risc

As the search for faster and more powerful processors goes on, chip design engineers have explored avenues that were thought of as dead ends.

One such path of development is the Reduced Instruction Set Computer (RISC).

This is a history of the "risky" business of such a development path :-

1975 IBM decide to look at possibility of a RISC system. Project 801.

1981 Researchers at University of California Berkeley, produce a paper on their design RISC 1. The resulting design out-performs the M68000.

Acorn decide to look for a new generation of powerful processors for the future.

1983 Acorn start looking at the RISC chip as a possibility for future high speed computers. A VLSI Laboratory was established within Acorn. The ARM project was conceived.

1985 The first ARMs are delivered. They run at 3 Mips (Million instructions per second).

1986 May 19th. The Application Specific Logic Products Division of VLSI Technology, Phoenix, Arizona and Acorn announce the 32 bit RISC chip that will be made available commercially. Coded VL86C010 (ARM).

Average execution rate of 4 Mips.

1987 August/September. Acorn launch the first of the Archimedes Series computers using the ARM RISC chip set.

DAY THREE - Afternoon	
Hardware	- More details of circuitry
Repair procedures	- Extensive hands on service exercise.
END OF DAY THREE	

DAY FOUR - Morning	
Repairs continued	
Returns	- GRA procedures.
Module Kit	- How to obtain your kit.
Questions & Answers	
END OF ARC2 and ARC21	

Course Timing

ARC1, ARC2, ARC11, ARC21
All courses start at 1.30 pm.

ARC1, ARC11
Courses finish at 12.30 pm on Day 3.

ARC2, ARC21
Courses finish at 12.30 pm on Day 4.

SECTION 1 : COURSE GUIDE AND INTRODUCTION

1 COURSE GUIDE

The ARCHIMEDES course has been designed to introduce trainees to the new A series. It will introduce the principles of RISC and introduce the service technique to those attending Day 3 of the course.

All participants are assumed to have a basic knowledge of computer operation and knowledge of previous Acorn models.

Course Objectives

At the end of the two day course all participants will have :-

* An understanding of RISC.
* Completed an overview of the Welcome disc with plenty of "hands on" experience.
* Assembled the package.
* Covered all customer "need to know" areas.

Course Codes

Course Identification Codes and support from Acorn will be discussed.

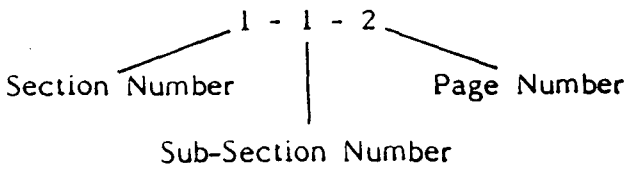
Course Materials

Participants will be given the following:-

* The Archimedes Course Manual
* Literature to reinforce the manual
* Any material that may be varied dependent on course being attended

Page Numbering

The code at the top of each page is derived from the page, sub-section and section of the book and is made up as shown below :-



This page number system allows cross reference with the index to check if any pages are missing.

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 5 : ADFS AND ANFS (ECONET)

CONTENTS

1. ADFS

Referring to Figure 5.1.

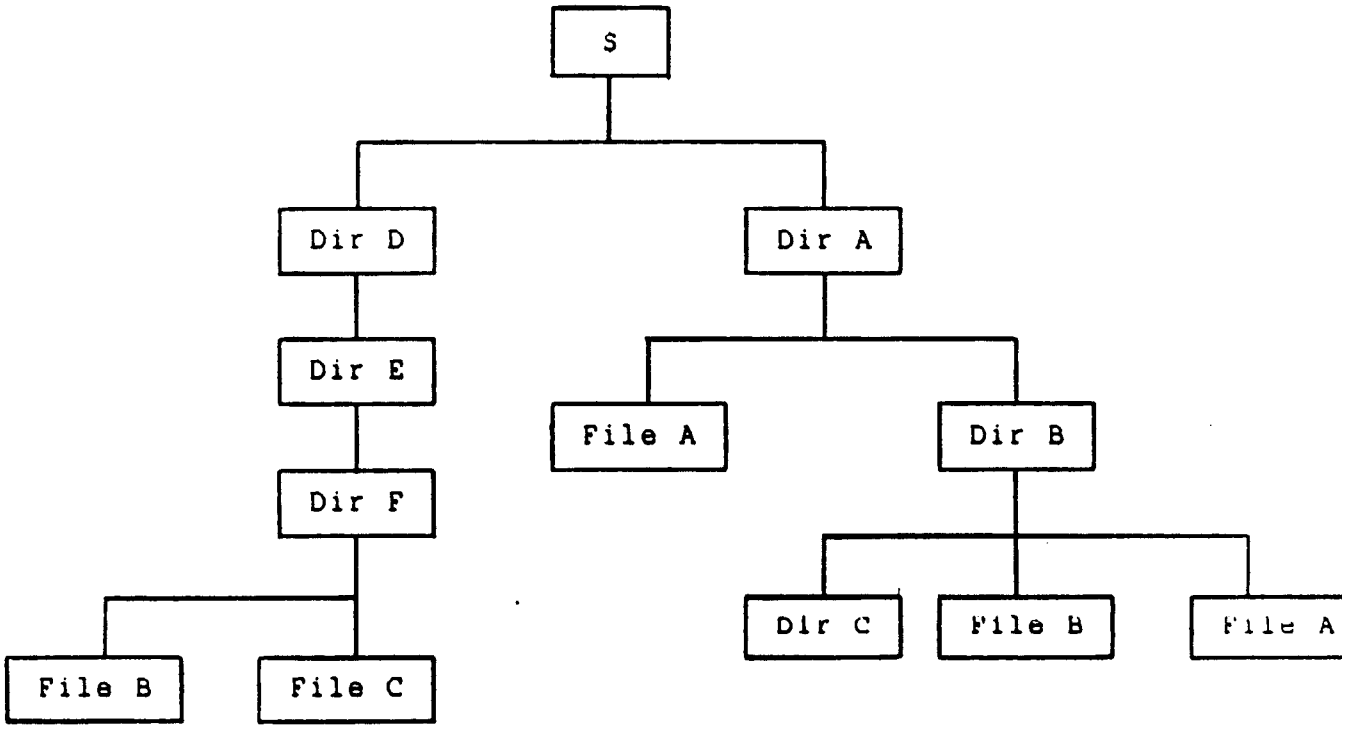
Acorn DFS uses a single directory approach which is normally named $. This then allows a set of parallel files to be accommodated.

If another directory is to be formed on the disc, only a single letter is permissable as the DIR name.

ADFS allows up to 77 directories and sub-directories within a directory, using a "family tree" or "root" approach.

$ is the "Root" directory or "Parent" directory and the next directory down a branch is the Parent for its lower directory and so on.

It can be seen in Figure 5.1 that more than one directory or file contains the same name. This is permissible in ADFS because using the root approach buffering takes place.



Further information on the ADFS system can be found in the USER GUIDE chapter 9, pages 69-91 or the PROGRAMMER'S REFERENCE MANUAL chapter 3

Figure 5.1 ADFS Flowchart

No	Floppy	Winchester
1st	0 or A	4 or E
2nd	1 or B	5 or F
3rd	2 or C	6 or G
4th	3 or D	7 or H

Table 5.1 Drive Numbering

Wildcards

There are two special symbols that can be used to refer to a group of files or directories in one command. The symbols * and # are referred to as wildcards.

The # is used to donate any single character. For example, AB# means that any single character following AB will be recognised, i.e., ABC or AB3, but not ABCD

The * is used to donate any sequence of characters any where in a name. For example, *DIR $.D* will list all files and directories in $ beginning with D, or *DIR $.DA* will list all files and directories in $ beginning with DA.

*Commands Applicable to ADFS

Some *Commands have been shown and explained to assist in using ADFS.

*Delete

Using this command an unlocked or empty file can be deleted.

*Access

*Access WR unlocks a file
*Access WRL locks a file

***Backup**

Using *backup 0 0 Q allows the contents of a source disc to be loaded into RAM and then written to a destination disc. Prompts will be displayed on the screen during this exercise.

***Format**

This command will lay out the disc surface in a series of pre-set areas called sectors. Any information on the disc will be effectively erased. Prompts will be displayed during this process.

The Archimedes can format 640k bytes or 800k bytes.

***Bye**

This command parks the disk drive head, allowing the machine to be transported.

Writing to a disc or saving data will create a file. Up to 10 alphanumeric characters may be used and it is not recommended to use other characters.

Directories and sub-directories may be referred to by special symbols :-

*DIR $: Root Directory

*DIR @ : Current Directory

*DIR ^ : The name of the directory directly above the current directory

*DIR % : Directory containing procedures and functions used frequently (Library)

*DIR & directory : A Directory you designate as your own root directory

To release a directory from it's current setting.		
*NODIR	*NOURD	*NOLIB

To add/modify disc/directory/file names.		
*TITLE	*RENAME	*NAMEDISC

To display the contents of a file on the monitor.			
*DUMP	*LIST	*TYPE	*PRINT

To report or adjust disc space availability.		
*FREE	*MAP	*COMPACT

To modify the information reported back by other ADFS commands.	
*OPT	*STAMP

Further information on these commands can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 3, the USER GUIDE chapter 9 or by using the *HELP option.

2. ANFS (ECONET)

Econet is a multiple station 4 wire network system employing microcomputers.

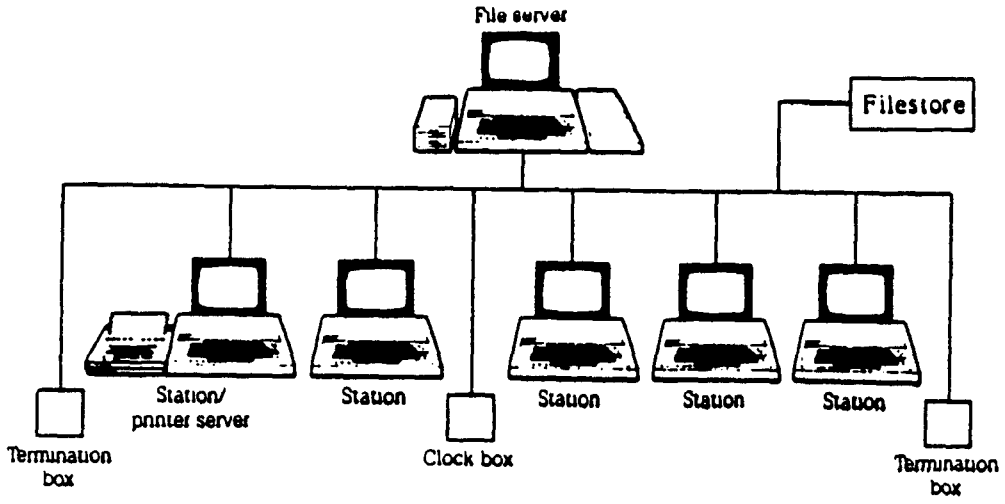


Figure 5.3 Typical Econet System

An example of a typical system is shown above and will consist of the following :-

*A number of stations (up to 254)
*A File Store (providing access to File and Printer services) or A File Server where no file store is provided
*A Printer Server
*2 Termination Boxes
1 Clock Box

Filestore

Filestore provides shared access to file and printer services. The services provided are fully compatible with Econet Level 3 file servers. (Viewdata system software included with E20 only.)

Level 3 File Server

Equipment required :-

Master Turbo fitted with Econet interface module, 10Mb or 30Mb Winchester (800K dual floppy disc drive*).

OR

Master 128 fitted with Econet interface module, 10Mb or 30Mb Winchester (800K dual floppy disc drives*), 6502 Second Processor.

OR

BBC Model (B+) with Econet interface, 10Mb or 30Mb Winchester (800K dual floppy disc drives*), 6502 Second Processor.

*Necessary for installing the network

Includes :-

File server Level 3 software on floppy disc
Viewdata system software on floppy disc
Battery backed real time clock module fitted with rechargeable battery
Level 3 File Server Initialisation Guide
Level 3 File Server Manager's Guide

The Printer Server

A station can be dedicated as a printer server so any hard copy to be printed out will be routed via this station.

In the event of the printer server being busy then, after approximately 30 secs, a message "Not Listening" will be displayed on your VDU.

Termination Boxes

The Econet System must have two termination boxes (one at each end of the line). This provides correct impedance termination.

Clock Box

In order for the system to operate efficiently a common clock frequency is required to synchronise all of the stations. This is supplied via pins 3/5 on the Econet socket.

Station ID

Station ID is set by software and held in configuration memory (non volatile) RAM.

No two stations should have the same station number.

Many of the commands used by ANFS are the same as those used by ADFS. Table 5.1 lists commands specific to ANFS or whose use has a different effect.

Syntax and further information on these commands can be found in Econet User and Advanced User Guides.

Command	Comments
*BYE	Logs off the current file server.
*I AM	Logs onto the system, (auto alias with LOGON).
*PASS	Sets the password.
*PS	Selects a printer server if more than one on the system.
*FX5,4	Selects a printer server other than a local printer.
*FS	Selects file server.
*Free	Informs the user of the free space on the disc.

Further information on these commands can be found in the ECONET USER GUIDE, the ADVANCED USER GUIDE and the PROGRAMMER'S REFERENCE MANUAL (chapter 3).

Table 5.1 ANFS Commands Table

Section Six
Arm Basic (Basic V)

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 6 : ARM BASIC (BASIC V)

CONTENTS

1. ARM BBC Basic

The Arm Basic interpreter is version V Basic. It contains improved version IV and additional new commands. Some error messages are revealed at point of error rather than later at program run, eg., missing" would be reported when the BASIC line was entered by pressing return rather than when the program is run.

BBC IV basic will run in ARM providing no illegal entry has been made. BBC V will not run in 6502 emulation mode if new statements are included in the program.

New Statements/Features

BPUT#<channel>,<string>	outputs contents of <string> + CHR$10 (unless ;)
CASE	marks the start of a CASE... OF... WHEN... OTHERWISE... ENDCASE statement
CIRCLE x,y,r	circle outline, centre x,y radius r equivalent to MOVE x,y:PLOT&95,x+r,y
CIRCLE FILL x,y,r	circle fill cente x,y radius r equivalent to MOVE x,y:PLOT&9D,x+r,y
COLOUR a,b	define logical colour a to be physical colour b equivalent to VDU19,a,b;0;
COLOUR a,r,g,b	define logical colour a to be physical colour <r,g,b> equivalent to VDU19,a,p,r,g,b
ERROR <number>,<string>	causes error reported as <string>,ERR<number>
IF	IF may now be used over several BASIC lines and is terminated by the ENDIF statement.
GCOL c	sets graphics colour equivalent to GCOL 0,c
FILL a,b	flood fill in foreground over background from a,b
LINE x1,y1,x2,y2	draw a line from x1,y1 to x2,y2 equivalent to MOVE x1,y1:DRAW x2,y2
LINE INPUT	equivalent to INPUT LINE
MID$(a$,n{,m})=b$	assign characters from b$ into a $, starting at position n up to the smallest of m, LENbS, LENaS-n
MOUSE x,y,z	sets x,y to current mouse position (in range 0..65535) sets z to buttons:bit 2,1,0 are LEFT, MIDDLE, RIGHT (bits set if button down)
OFF	turn the cursor off
ON	turn the cursor on
ORIGIN x,y	set graphics origin to x,y equivalent to VDU29,x;y;
POINT x,y	plot a single point at x,y equivalent to PLOT69,x,y

Example :

```
LET X+=1
A(1,2,3)+=2
X%-=VALA$
X="A"
```

New Commands

APPEND	Appends file to program
EDITO	EDIT with LISTO capability
HELP	prints various usages
HELP keyword	prints help on this keyword
LVAR	displays all variables, procedures and functions
SAVE	save <return> saves program to name after REM > on the first line
LISTO	0 gives no enhancements, as before
	bit 0=1: space after the line number
	bit 1=1: indent structures
	bit 2=1:split at the : statement delimiter
	bit 3=1: don't list the line number, error at line number references
	bit 4=1: list tokens in lower case

Procedures

Arrays may be passed to procedures.

Enhanced TRACE Statement

AB has the ability to trace procedures and functions and the ability to TRACE in single step mode

```
TRACE PROC
TRACE STEP ON
TRACE STEP 1000
TRACE STEP PROC
```

Single step mode gives the number of procedure name in { } instead of [ ] and waits for a key to be pressed before continuing.

When only 4 channels are used, registers 4, 5, 6, 7 should be programmed to the same values as registers 0, 1, 2, 3 respectively.

When only 2 channels are used, registers 0, 2, 4 and 6 pertain to one channel, and so shoud be programmed to the same value, and registers 1, 3, 5 and 7 pertain to the other channel.

When only one channel is used, all 8 registers should be programmed to the same value.

The computer contains a sound synthesiser which enables you to imitate up to eight different instruments playing at once, giving either mono or stereo sound production for each instrument. The sound can be activated or de-activated using the statements :-

SOUND ON and SOUND OFF

You need to select how many different sound channels you wish to use. The default value is one, however you can alter this by typing :-

VOICES n

n = number of sound channel between 1-8.

The Sound Statement

BASIC provides a SOUND statement to create a note on any of the channels. This requires four parameters which can be summarised as follows :-

SOUND channel, amplitude, pitch, duration

Channel :
There are eight different channels, numbered 1-8. Each of these is identical.

Amplitude :
Setting the second parameter to an integer between 0 and -15 determines how loud a note is to be played. a value of -15 is the loudest, -7 is half-volume and zero produces silence.

Alternatively, a logarithmic scale can be used by giving a value between 256 (&100) and 383 (&17F). A change of 16 represents a doubling or halving of the volume.

The Tempo Statement

The rate at which the beat counter counts depends on the tempo which can be set as follows :-

TEMPO n

n = number of beats per centi-second, 1000 = 1 tempo beat per centi-second, Doubling value of n doubles tempo

To find the current tempo type :-

PRINT TEMPO

Sounds can be scheduled to happen a given number to beats from the last reset by giving a fifth parameter to the SOUND statement. For example :

```
10 BEATS 200
15 VOICES 2
20 *CHANNELVOICE 1 1
30 *CHANNELVOICE 2 1
40 REPEAT
50   REPEAT UNTIL BEAT=0
60   SOUND 1, -15, 100, 5, 50
70   SOUND 2, -15, 200, 5, 150
80   REPEAT UNTIL BEAT<>0
90 UNTIL FALSE
```

Increasing the number of beats decreases the time taken before the two notes are repeated. It has no effect on the time interval between the two notes themselves. Increasing the tempo decreases both the time taken before the two notes are repeated and the time interval between the two notes.

Stereo

Statement setting the stereo position of a sound channel.

The operating system uses three modules to control the generation of sound. These are Sound DMA, Sound Channels and Sound Scheduler. They all have their own * commands, a summary of which is given below.

Command.	Comments.
*AUDIO	Switches the sound system ON and OFF.
*SPEAKER	Switches the speaker ON and OFF.
*STEREO	Sets the position of a sound channel between full left and full right.
*VOLUME	Sets the audio channel volume level.
*VOICE	Lists the installed voices (eg: instruments) and channel allocation.
*CHANNELVOICE	Allocates a voice to a channel.
*SOUND	Makes a sound (as in BASIC).
*TUNING	Sets the system tuning. (can be used to match sound to another sound source).
*TEMPO	Sets the system tempo.
*QSOUND	Queues a sound after a specific time period.

Further information on these commands can be found in the PROGRAMMER'S REFERENCE MANUAL chapter 7 or by using the *HELP option.

Table 6.1 Sound *Commands

```
 3,"Bad register"
 4,"Missing ="
 4,"Missing in FOR statement"
 4,"Mistake"
 5,"Missing ,"
 6,"Type mismatch: number needed"
 6,"Type mismatch: numeric variable needed"
 6,"Type mismatch: string needed"
 6,"Type mismatch: array needed"
 6,"Type mismatch between arrays"
 6,"Can't assign to array of this size"
 6,"Array type mismatch as parameter"
 6,"Can't SWAP arrays of different types"
 7,"Not in a function"
 8,"Too low a value for $¼numbers½"
 9,"Missing"
10,"DIM() function needs an array"
10,"No room for this dimension"
10,"Impossible dimension"
10,"No end of dimension list )"
10,"Bad DIM statement"
10,"Can't DIM negative amount"
10,"No room for this DIM"
10,"Arrays cannot be redimensioned"
12,"Items can only be made local in a function or procedure"
13,"Not in a procedure"
14,"Reference array incorrect"
14,"Unknown array"
14,"Unknown array in DIM () function"
14,"Undimensioned array"
15,"Subscript out of range"
15,"Incorrect number of subscripts"
16,"Syntax error"
17,"Escape"
18,"Division by zero"
19,"String too long"
20,"Number too big"
```

(continued over...)

2. APPLICATIONS SOFTWARE

Refer to booklet that accompanies this course.

Applications Software will become available from approximately September onwards. Any software errors should be notified to the Sofware House and/or Acorn immediately.

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 7 : USER MAINTENANCE

CONTENTS

Section Seven
User Maintenance

1. USER MAINTENANCE

This section is primarily concerned with the end user and any problems that they may encounter during use of the machine.

It is recommended that the cleaning of the fan filter and battery replacement are covered when a purchase is made as these are not covered under the warranty.

Emphasis should be made upon the safety aspect and that electronic equipment should not be used with the cover removed.

Prior to returning any part of a system for repair a total check should be made to eliminate "finger trouble".

Upper Case Removal

Referring to Figure 7.1.

Prior to any connection/disconnection or entry to the computer unit the mains must be switched off.

1) Remove 3 screws along upper rear of case.

2) Remove 2 screws, 1 each side of forward edge.

3) Slide upper case backwards and remove.

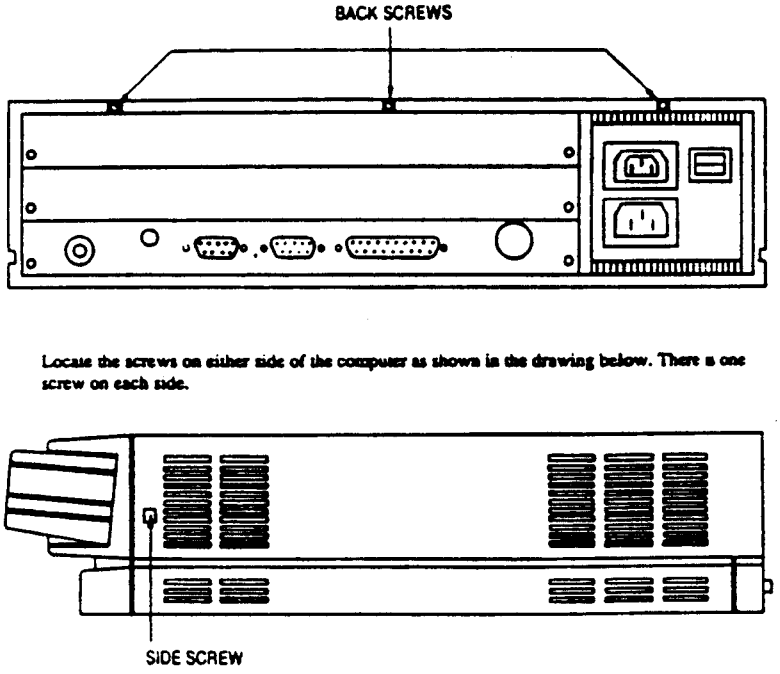


Figure 7.1 Top Case Removal

Fan (where fitted)

Where a Winchester Disc Drive back plane assembly is fitted there is a need for additional cooling within the confines of the computer. To this end a 60mm diameter fan is fitted to supply the air flow requirement.

The fan is fitted on the forward LHS and fixed with for bolts and nuts.

A filter protects the internal electronics from dust, dirt, fumes, etc.

Filter Removal

Referring to Figure 7.4.

Disassemble the upper case and front moulding.

Remove the fan assembly by unscrewing the four nuts and bolts. Remove the filter and clean/replace as required.

(Note that the filter has holes punched for the fan fixing bolts to pass through.)

Test the fan and reassemble the case.

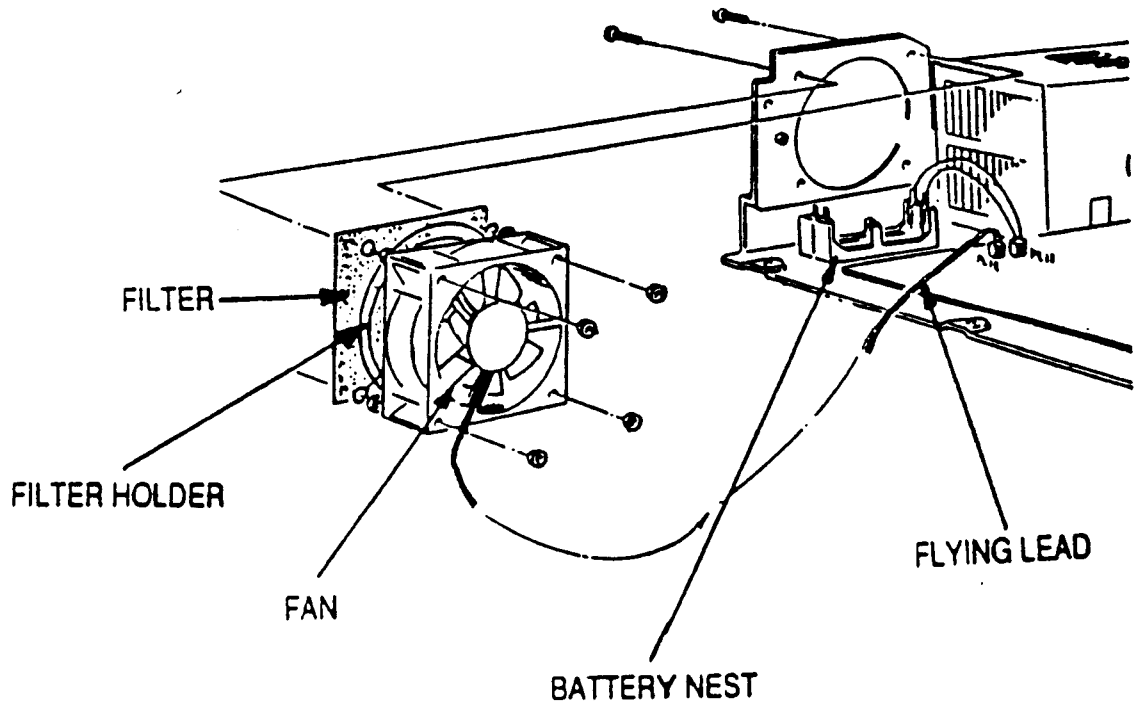


Figure 7.4 Fan Filter Removal

2. SID ACORN SUPPORT INFORMATION DATABASE

The Acorn Support Information Database (SID) has been created primarily to provide support information, both of a technical and a general nature, to our various sales and service organisations.

To allow SID to be compatible with as wide a range of terminals as possible, SID conforms to the PRESTEL standard using both the teletext character set and telesoftware formats; the system also operates at 1200/75 baud.

SID is available on the following telephone number :-

Cambridge (0223) 243642

Once the connection to SID has been made, the user is required to log-on to the system. To do this requires the input of a USER ID and a corresponding PASSWORD. For guest users the USER ID is 1999 with the PASSWORD 1999. This will allow limited access to the system with some areas of information not available to them. Users who subscribe to the system will have been provided with a unique USER ID and PASSWORD which they should ensure is NOT given to other people.

If you have any problems using SID or suggestions for additions or extensions you would like to see on the system please write to :-

The Editor (SID)
Field Support and Services
Acorn Computers Limited
Technopark
645 Newmarket Road
Cambridge
CB5 8PD

An accompanying booklet on the course contains a detailed explanation of the use of SID and the commands required to access the system.

3. DEAD ON ARRIVAL PROCEDURE

The procedure for goods that arrive DOA is the same as any other Acorn product.

A Goods Return Authorisation (GRA) must be obtained from Acorn at Cambridge and the faulty goods then returned.

The return of any product deemed DOA will be liable the same penalty if the goods were not faulty as other Acorn products.

Any goods returned without a GRA will be at the dealer's or ASC's cost.

Dealer Hot Line

Dealer hot lines will be made available for dealers to obtain information by phone from Acorn.

One line will deal with dealer queries and one line will deal with educational queries.

Section Eight
Hardware: Diagnosis: Repair Procedure

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 8 : HARDWARE: DIAGNOSIS: SERVICE

CONTENTS

1. HARDWARE

Circuit Details

Referring to Figures 8.1.

Communications between ARM and the rest of the RISC chip set are shown.

Address communications between ARM and MEMC are direct.

Addressing to ROM is latched via ICs 28, 35, 36.

Addressing to RAM is memory requested Column and Row addressing.

VIDC does not directly address any memory but has $\overline{\text{VIDRQ}}$ for Video Request and $\overline{\text{SNDRQ}}$ for Sound Request.

$\overline{\text{VIDRQ}}$ communicates with MEMC via IC44 (not shown) for direct memory access (DMA) of video information. MEMC will acknowledge the request with $\overline{\text{VIDAK}}$. $\overline{\text{SNDRQ}}$ communicates with MEMC directly for DMA of sound information and receives $\overline{\text{SNDAK}}$ as an acknowledgement.

The use of DMA enables the system to speed up display and audio information by by-passing the ARM. D-A conversion takes place in VIDC and the resultant analogue signal is applied to its relevant output.

IOC uses latched addressing and reconfigures D16-D23 to BD0-BD7 and D24-D31 to BD8-BD15. This is processed via a parallel in/serial out (PISO) buffer for keyboard, etc.

As mentioned previously, RAM is Column/Row addressed. Read/Write decoding is supplied by IC59.

Hardware

Referring to Figure 8.2.

Removal of the case reveals :-

i) Main PCB and electronics

ii) Switched Mode Power Supply Block

iii) Batteries and battery holder

iv) Backplane socket (where fitted)

v) Floppy disc drive unit

vi) Fan (where fitted)

vii) Winchester Disc Drive (where fitted)

It is recommended that all live checks and power supply checks are carried out with the unit under test connected to an isolated mains source of 240V +/-5%.

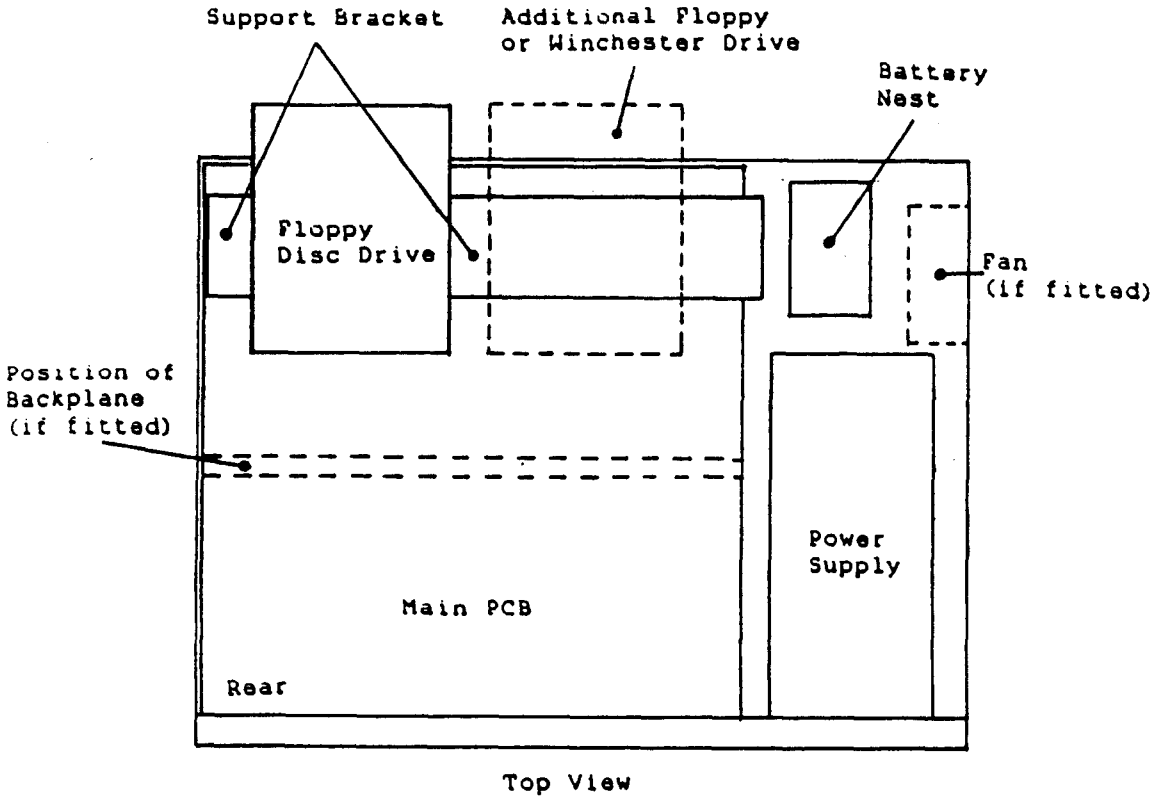


Figure 8.2 Internal Layout

Winchester Hard Disc (where fitted)

The Winchester hard disc is fitted to the front bracket assembly alongside the floppy disc drive.

Removal is by two screws as with the floppy and disconnection of all signal leads and power lead.

Removal of Power Supply

Referring to Figure 8.4.

The power supply is designed to be a direct replacement unit and is not a repairable item. Four screws retain the PSU module from the underside of the computer case.

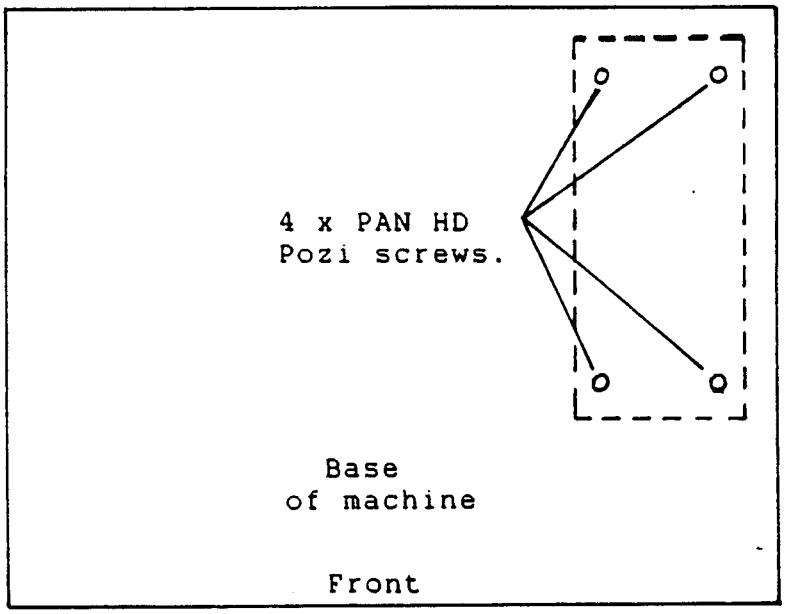


Figure 8.4 Removal of PSU Module

To remove/replace the PSU module :-

* Remove top case and front moulding.
* Remove external leads.
* Unplug power leads, noting colour of lead/positions.
* Remove fan assembly.
* Remove 4 screws retaining PSU module.
* Slide PSU module towards front of computer and remove.

To replace PSU module, reverse the above procedure.

2. DIAGNOSIS

Basic Test Procedures

Following the replacement/removal - refitting of any part of the computer system, excluding the monitor, checks should be made for earth continuity between Earth Pin of mains plug and :-

i) The lower case assembly.

ii) The three rear panels (1 in the PCB and 2 on blanking panels).

iii) The upper case assembly.
Ideally this test should be carried out using an Earth Continuity tester set to 25Amps.

The unit must **NOT** plugged into the supply during this operation.

All tests must be to bare metal and not painted metal.

Sound and Vision Checks

Referring to flow charts for sound and vision checks.

Each of these flow charts is designed to function assuming that the fault has been isolated to the main computer unit. It is quicker and easier to check the keyboard, monitor, mouse, etc., by substitution.

Referring to Figures 8.6 - 8.8.

These figures indicate test points for simple testing to be carried out prior to a board being exchanged.

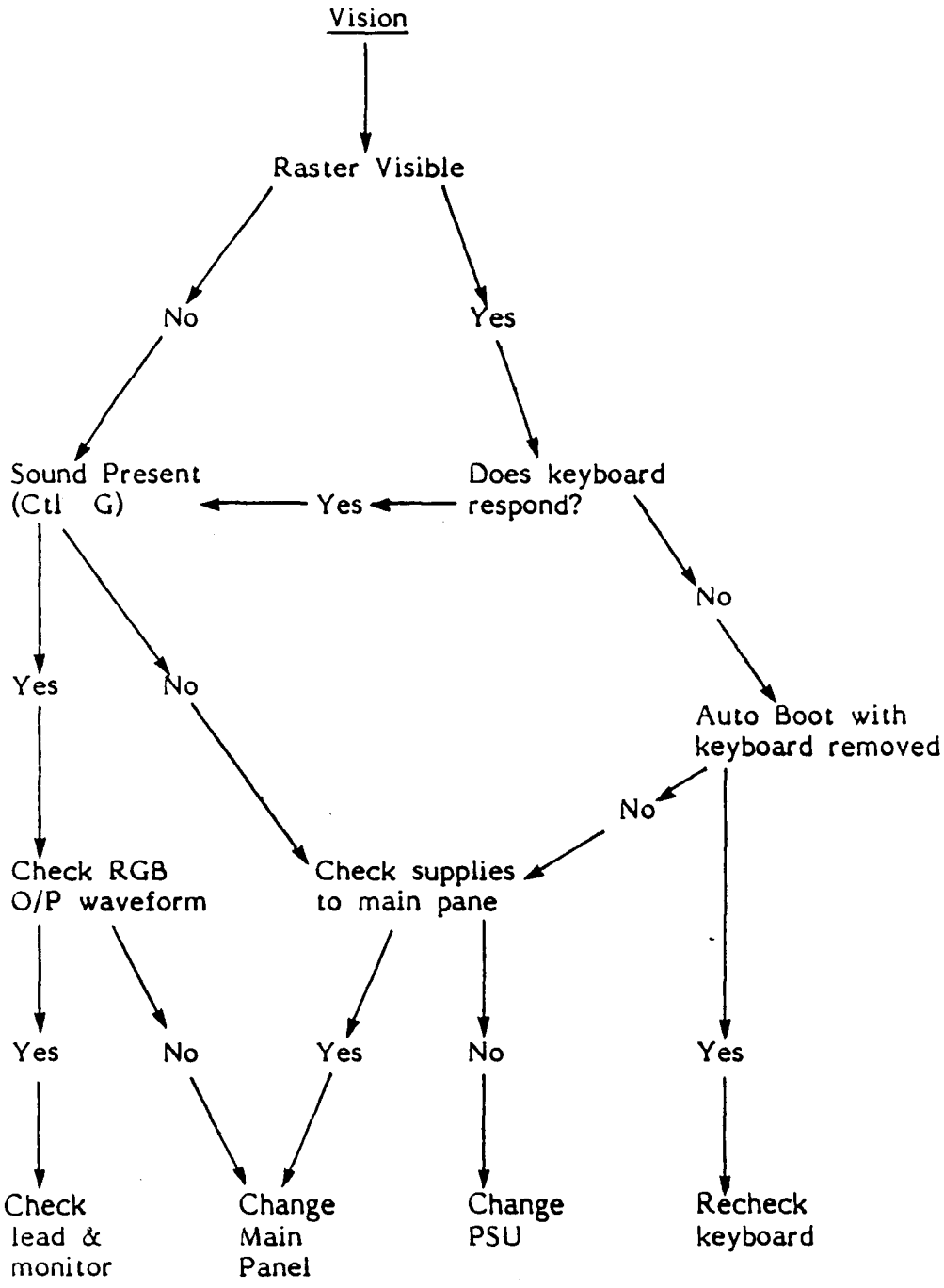
Any oscilloscope waveform wil be dependent on the signal of the test point, eg., RGB analogue signals will vary in level, if present, depending on the level of any primary colour required.

Printer test signals should be checked after a replacement printer and/or lead have been fitted.

The "ground" lead of test equipment should be as close as possible to the test point to minimise interference.

Vision Fault Finding Guide

Symptoms - No VDU display.



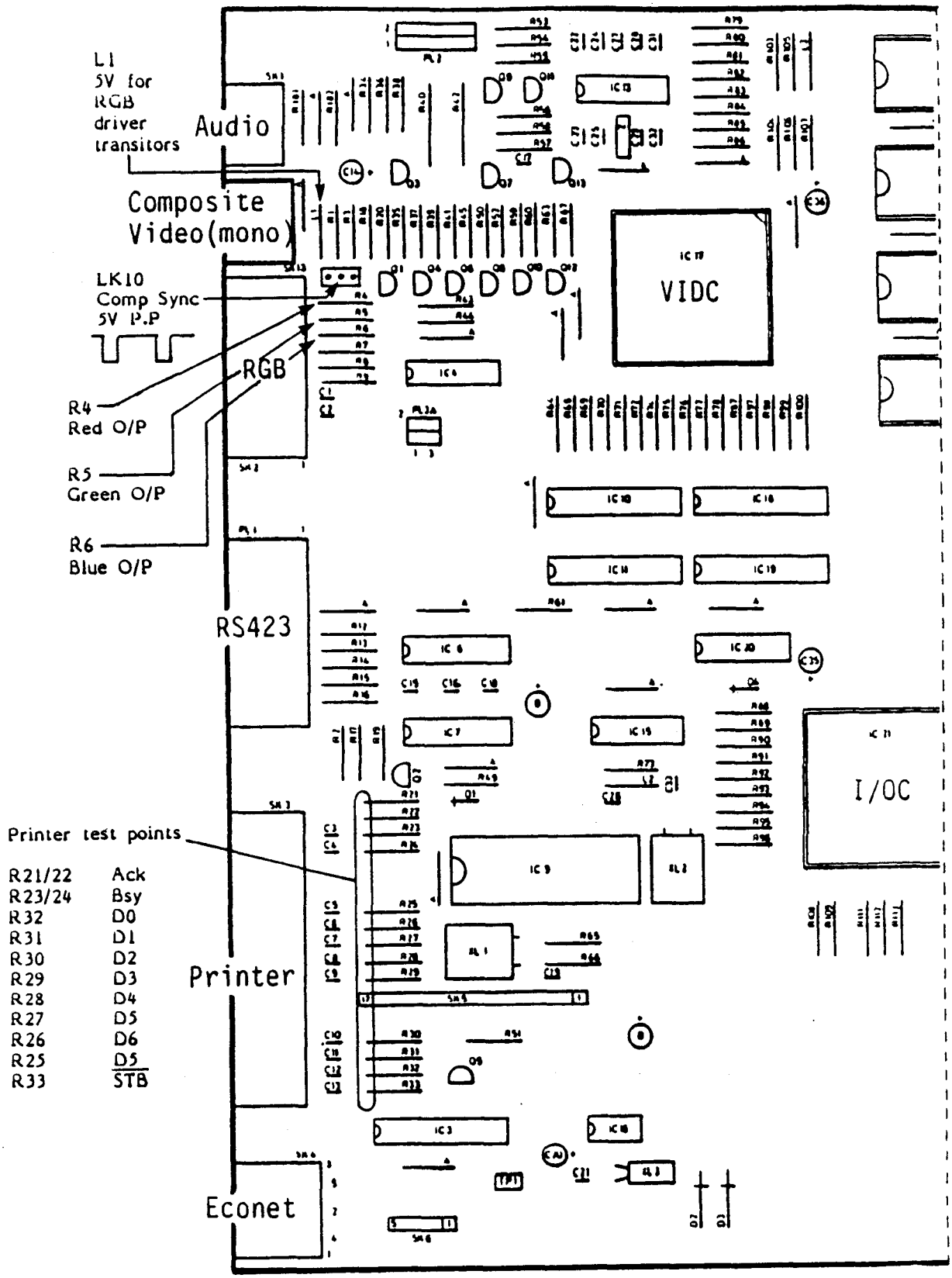


Figure 8.7 Simple Test Points (2)

Functional Test Procedures

The following Test Procedures are a condensed version of the A300 series 0.5 and 1M Engineering Test Procedures 1987.

Equipment required :-

a) The Unit Under Test (UUT)
b) An A1 keyboard - 0376,100 (Front panel connector)
c) A 3.5" Test Disc (0276,080), write protected
d) A formatted, non-write protected 3.5" disc
e) An RS423 'Loopback' plug - 0276,081 ('RS423')
f) An Epson FX80 or Olivetti JP101 printer ('Parallel Printer')
g) A pair of 32ohm Stereo Headphones ('Headphones 32ohms)
h) A monochrome monitor ('Mono Video')
i) An analogue RGB monitor ('Analogue RGB')

Items a) to e) are designed and specified by Acorn Computers Limited and may not be changed without written consent from Acorn.

It is assumed that items f) to i) are complete with the correct cables to allow them to be connected to the rear of the A1 PCB using the Plug/Socket detailed in brackets above.

Item f) may be replaced by any other manufacturer's direct functional equivalent (in terms of **BOTH** hardware interface and software).

Note - At all times during the test procedure the power shall be the last connection made before the test commences, and the first connection removed when the testing is complete.

Power-Up Procedure

Turn on all equipment EXCEPT the UUT. Ensure printer is selected for On Line operation.

Turn on the UUT. The screen message should display some start-up information, followed by the prompt signal (>) and a flashing cursor.

Insert the test disc (Item C-1 c)) into the disc drive.

Hold down the Shift key, press and release the Break key, and then release the Shift key. The screen should display the following :-

```
TEST OPTIONS

A Keyboard Test
B Other Tests Except Printer
C Other Tests and EPSON Printer
D Other Tests and JP101 Printer
```

Time Test

Screen display :-

```
Do you want to ?
1. Check the Date and Time
2. Set the Date and Time
3. Check then set the Date and Time
PRESS 1 or 2 or 3
```

Loudspeaker Test

Screen display :-

```
LOUDSPEAKER TEST
LISTEN AND CHECK SOUND
THEN PRESS SPACE TO CONTINUE
```

Action : A short repeating sequence of 5 "musical" notes is played. The operator should listen and reject if there is any deviation.

Headphone Test

Screen display :-

```
HEADPHONE TEST RUNNING
LISTEN AND CHECK SOUND
THEN PRESS SPACE TO CONTINUE
```

Action: A short sequence of 8 "musical" notes is played. The first four on one headphone and the second four on the other. This sequence is repeated. The operator should listen and reject if there is any deviation.

Keyboard/Mouse Test

Ensure that the equipment is connected as follows :-

a) The 6-pin 'Minidin' attached to the curly cable on the UUT must be connected to the 6-way socket on the front of the Computer.

b) The 9-pin 'Minidin' attached to the mouse must be connected to the 9-way socket on the rear of the UUT.

c) Insert the test disc into the drive of the computer (if not already inserted). Ensure it is pushed fully home.

Hold the Shift key down. Press and release the Break key. Release the Shift key.

The screen will clear and the following menu will be displayed :-

TEST OPTIONS

A) Keyboard Test
B) Other Tests Except Printer
C) Other Tests and Epson Printer
D) Other Tests and JP101 Printer

Select option A) by pressing A . The following tests will then be executed:-

Keys Stuck :-

If any of the keys or mouse buttons are in a permanently closed position (i.e., stuck down) then these keys will be displayed on the screen and it will be impossible to continue the test. The keyboard must be rejected. If everything is normal and no keys are stuck then there will be no screen display and the program will pass straight on to the next test.

LED Tests :-

This tests that LED's on the Caps Lock , Scroll Lock and Num Lock keys are working. The screen display gives instructions when to check that each LED is On and Off. Pressing Break moves to the next instruction. Any LED failures should be noted before continuing the test.

Pressing Break then moves on the next tests.

3. SERVICE

Archimedes Repair Cycle

The following procedure assumes that the Archimedes vendor and Archimedes service agent are one and the same. Where this is not the case, the 'faulty' system will be transferred between the vendor and the service agent at Procedure point 6.

1. End customer approaches supplying vendor with Archimedes unit that he deems faulty.

2. Vendor determines whether problem experienced by customer relates to usability, software or hardware.

3. Vendor resolves usability problems (finger trouble, lack of understanding) directly.

4. If a genuine software problem is suspected then vendor reports the problem and its symptoms to Acorn via a Software Report For (see example).

5. If a hardware fault is suspected, vendor tests unit by running test software resident upon Archimedes Test Disc. If test confirms malfunction, then submit for repoar (go to 6), otherwise revisit points 3 and 4 above.

6. Service agent confirms fault and identifies faulty module or fitting.

7. Service agent disassembles unit (if appropriate), replaces faulty module with good module (from his own stock), re-assembles unit and re-tests using software on Archimedes Test Disc.

8. Service agent checks warranty status of unit and charges customer if unit out of Acorn warranty.

9. Service agent complest a Service Report identifying :-

   a) serial number of unit
   b) serial number of faulty module (if any)
   c) serial number of replacement module (if appropriate)
   d) date or repair
   e) customers name
   f) service agents Name, address and Acorn Account Code
   g) date of purchase (for cross-checking purposes)
   h) whether a warrantly repair is being claimed or a chargeable repair
   i) the external fauly symptoms.

10. If the faulty module is determined to be the Archimedes Main PCB, then the service agent packages Service Report with faulty PCB (packaging comprises anti-static bag within a purpose-made foam-lined cardboard box) and despatches to designated Central Workshop using Acorn supplied pre-paid postage labels.

FAULT REPORT FORM

Please report one fault per form FR Ref:

Problem reported by:

Name _____

Organisation _____

Address _____

_____

_____

Telephone _____ Date _____

Configuration

Serial Number: _____

Other Peripherals:

_____

_____

_____

_____

_____

_____

Filing Systems

DFS floppy: ☐

ADFS floppy: ☐

ADFS hard: ☐

NFS ☐

Suspected problem source

Operating system: _____ O.S. Version Number _____

Os. Utility: _____

Language: _____

Other software item: _____

Version number(s): _____

Issue number: _____

Length of time switched on before failure _____

Description of problem

Describe the problem as fully as possible, attaching further sheets and supporting material if appropriate. If the problem is reproducible, please also provide sufficient information to re-generate it (for example, a program listing or disc).

Return to Mark Hall, Acorn Computers, Cambridge Technopark, 645 Newmarket Road, Cambridge CB5 8PB

Replacement of Faulty Modules

Upon receipt of any faulty module returned for repair, Acorn will have a replacement despatched. Any delay will be minimised to postal efects rather than Acorn handling.

Any dealer/service agent handling large quantities of machines may need to increase their spare module stock levels.

The Archimedes main PCB must be returned to the Central Workshop for repair and not to Acorn.

VDUs may be repaired by Service Centres if they have the necessary facilities.

Archimedes 300 Series modules consist of :-

Main 305 PCB
PSU
Disc Drive
Keyboard PCB
Mouse
Disc drive cable
Speaker LED assembly
Battery assembly
0.5Mbyte of DRAM

Module Kit

Persons attending the ARC2 course will receive, as part of the course, a complete module kit containig 1 of each of the modules.

Any additional modules required must be purchased separately along with such items as User Guide/Welcome Disc, etc.

Spares lists/price lists will be published from time to time via SID.

Only persons attending courses relating to service techniques will be allowed access to replacement modules.

ARCHIMEDES Service Registration

June 1987

Dear Colleage,

All organisations approved to sell ARCHIMEDES product must also establish service facilities to ensure that the product may be repaired and serviced.

Please complete the following and return to Field Support and Services Dept., Acorn Computers Ltd., Unit 3, Cambridge Technopark, indicating your service arrangements.

Name of Organisation: _____

Address: _____

_____

_____

_____

Acorn Account No.: _____

Do you propose to undertake service of the ARCHIMEDES product yourself? **YES/NO**

If NO, please indicate the organisation who will undertake service on your behalf

Name of Service Organisation: _____

Address: _____

_____

_____

_____

ASC No.: _____

Doc.ref.: ServReg *Appendix 2* *June 1987*

GOODS RETURN AUTHORISATION

GRA No. 1000

ACORN COMPUTERS LTD
Cambridge Technopark
645 Newmarket Road
CAMBRIDGE
CB5 8PD
Tel: 0223 214411 Telex 81152 ACNNMR G
Fax: 0223 214382

Dead on Arrival	X
Warranty repair	

Valid to: 06 Jul 87
DEALER COPY

Dealer Name and Address
Dealer's name and address
go here

Goods to be returned to:
Granada Microcare
as per enclosed pre-paid
label

FAO: Mr Jones

Dealer no	Customers Ref	Account No.	Raised by	Date
01-246-8081	Debit 2154	100001	Alan Jones	06 Jul 87

Item No.	Prod Code	Description	Inv No.	Serial Nos	Qty	Reason	POP Req
1	AKB10	Archimedes 305	10546	27-AKB10-5678901	1	DOA	

Authorised for return by (NAME) James Smith Signature

CREDIT WILL BE ISSUED AFTER AUDITING OF ORIGINAL GOODS

Sheet 1

Section Nine
Appendix

ARCHIMEDES PRODUCT SUPPORT AND SERVICE TRAINING

SECTION 9 : APPENDIX

CONTENTS

1. ASSEMBLY LANGUAGE PROGRAMMING AND INSTRUCTION SET

Assembly Language Programming

The basic assembler incorporated in Basic V is the same as the Basic IV assembler in use, therefore anyone familiar with programming earlier BBC machines will only have to come to grips with the new instruction set.

All of the machine code instructions can be performed conditionally depending on the status of one or more of four flags, these are :-

C - carry flag
N - negative flag
V - overflow flag
Z - zero flag

The various combinations of these flags give 16 possible conditions listed in Table 1. The instruction set is given in Table 2.

Code	Comments
AL	Always carry out instruction irrespective of the condition code.
CC	Carry clear.
CS	Carry set.
EQ	Equal.
GE	Greater than or equal to.
GT	Greater than.
HI	Higher (unsigned).
LE	Less than or equal to.
LS	Lower or same.
LT	Less than.
MI	Negative (minus).
NE	Not equal.
NV	Never (instruction not executed - NOP).
PL	Positive.
VC	Overflow clear.
VS	Overflow set.

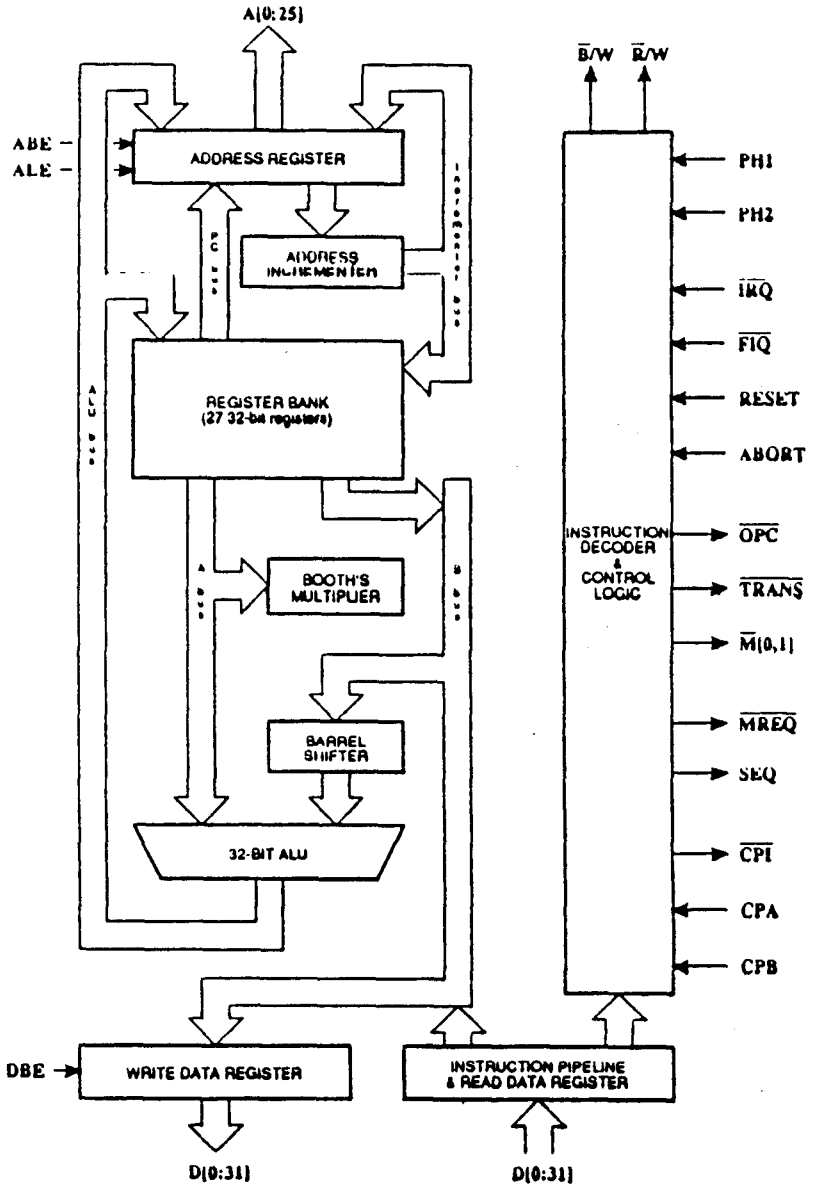
Note: Two of these may be given alternative names as follows:

LO Lower unsigned is equivalent to CC.
HS Higher/Same unsigned is equivalent to CS.

2. THE ACORN CHIP SET

The Acorn chip set consists of four ICs, including the ARM.

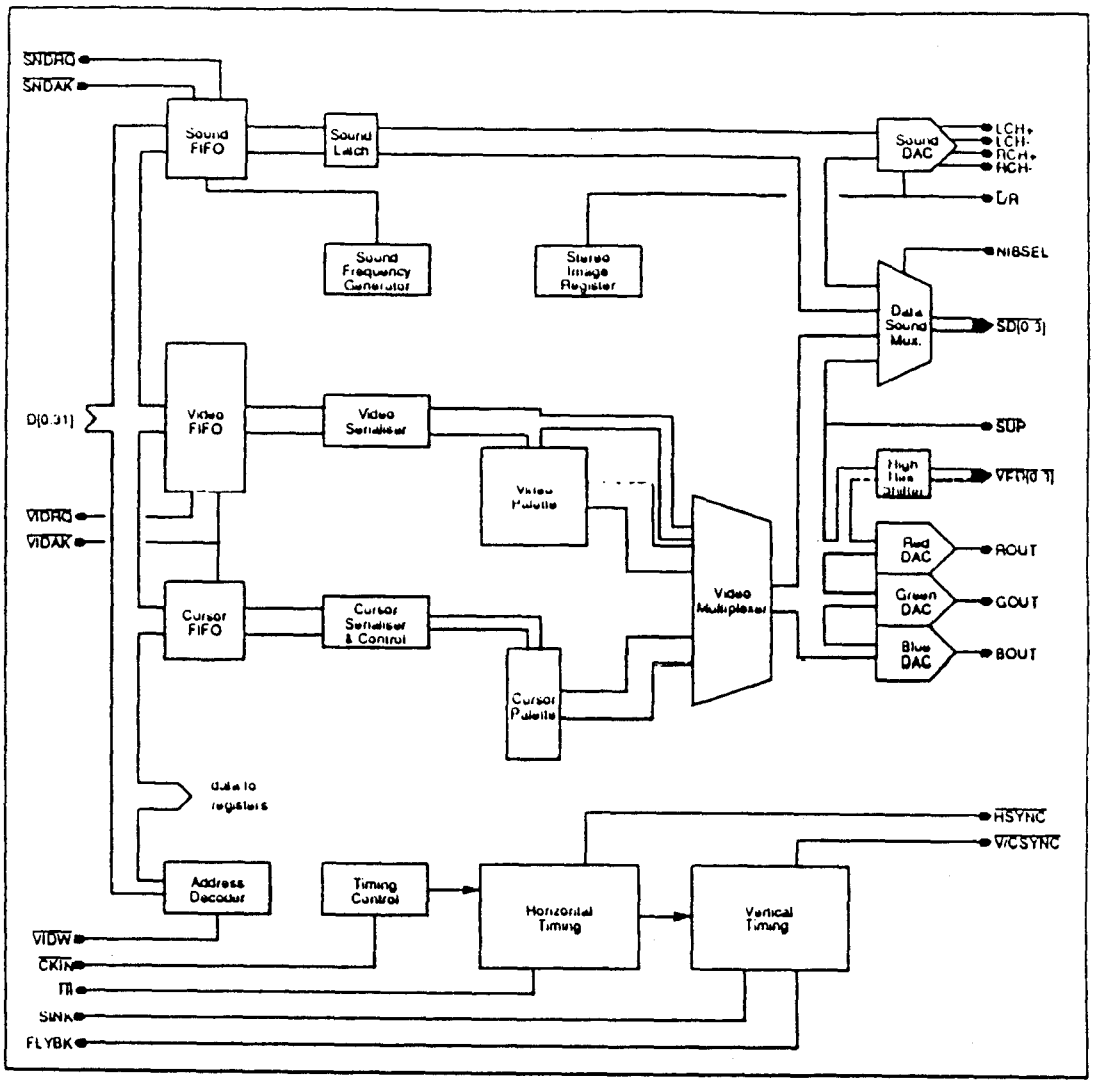
The ARM Chip Internal Structure



Features :-

* 32-bit data bus
* 26-bit address bus giving a 64-MByte uniform address space
* Support for virtual memory systems
* Simple but powerful instruction set
* Co-Processor interface for instruction set extension
* Good high-level language compiler support
* Peak execution rate of 10 million instructions per second (MIPS)
* Fast interrupt response for real-time applications
* Low power consumption (0.1W typical) with a single +5V supply
* 84-pin JEDEC B leadless chip carrier or plastic leaded chip carrier

The VIDC Chip Internal Structure



Features :-

* Pixel rate selectable as 8, 12, 16 or 24MHz
* Serialises data to 1, 2, 4 or 8 bits per pixel
* 16 word by 4096 colour look-up palette
* 4-bit DACs for each CRT gun
* Highly programmable screen parameters
* Border facility
* Cursor sprite
* Optional interlaced sync, display format
* Allowance for external synchronisation
* Very high resolution and monochrome mode
* High quality stereo sound generation
* Fabricated in CMOS for low power

Customer Survey

Your co-operation in completing the following customer survey would be much appreciated.

1 Where did you buy your Archimedes?

- Specialist computer dealer ☐
- Electrical retailer ☐
- Department Store ☐
- Mail Order ☐
- Other ☐

2 How did you hear about Archimedes, or where did you see it advertised?

_____

_____

3 In which areas do you intend to use your Archimedes?

- Business ☐
- Education ☐
- Home ☐
- Research ☐
- Other ☐

4 Do you already own a computer?

If so, what make and type is it? _____

5 Will you be connecting your Archimedes to a network?

If so, which network? _____

6 Do you have any plans to buy upgrades for your Archimedes?

If so, which upgrades? _____

3. OWNER DOCUMENTATION

Introductory Letter

Acorn Computers Limited
Cambridge Technopark
645 Newmarket Road
Cambridge CB5 8PB

Telex 81152 ACNNMR G
Fax No 0223 214382

EXAMPLE

Dear Owner

We would like to thank you for purchasing the Archimedes desktop microcomputer. We are confident that this powerful and innovative system will provide you with useful and productive service throughout it's working life.

We would like to take a few minutes of your time and ask you to complete and return the attached reply-paid Owner Registration form. Although not mandatory for warranty purposes, your registration is of great assistance to us in keeping track of our valued and growing family of users, and in verifying and speeding up the processing of any guarantee or service claims. You are of course not obliged to answer any particular question or questions should you prefer to leave them blank.

This particular computer is a member of the first manufactured batch of Archimedes systems, and as such contains the first issue of the Arthur Operating System in a 256kb EPROM set. It is Acorn's intention later this year to supply free of charge an upgraded operating system in a 512kb ROM set to the owners of all of this first batch of systems. In addition, we will be happy to send you without charge our new word processor package for Archimedes. Please assist us by returning your completed Registration form as soon as possible.

From time to time Acorn is approached by other Companies whose products and services are potentially of great benefit to our system purchasers and users. If you would rather not receive details from third party suppliers please indicate as appropriate on the attached Registration form – we will respect your preference absolutely.

If you have any problems with the use of this Archimedes computer please in the first instance approach your supplier. In the event that your supplier is unable to resolve your problems, or you have any suggestions for improvements to our products, please use the enclosed User Response form. We may not necessarily be able to write back individually, but please be assured that your comments will receive our detailed attention.

Happy computing.

Acorn Computers Limited

Registered Office: Acorn Computers Limited
Fulbourn Road, Cherry Hinton
Cambridge CB1 4JN England
Registered No 1403810
VAT No 215 4002 20

0476,020-1 JUNE 87

OWNER REGISTRATION FORM

Name:

Address:

Postcode:

EXAMPLE

DOUBLE SIDED !

Unit Serial Number: [ ] - [ ] - [ ]

eg 01 AKB10 30040557

Date of Purchase: [ ]

Please indicate your selection by ticking one or more boxes below as appropriate.

☐ Please register me for Warranty authorisation purposes. Please add my name to your mailing lists so that I can be advised of new product developments and upgrades available for my system from Acorn or from third party suppliers.

OR

☐ Please register me for Warranty authorisation purposes ONLY. Please **do not** add my name to your mailing lists or disclose it to third parties.

☐ Please supply me with information about Customer Training Courses.

☐ Please tell me about the Acorn SUPPORT INFORMATION DATABASE (SID) and about how I can access it on-line.

☐ Please send me details of the ON-SITE MAINTENANCE schemes for my system.

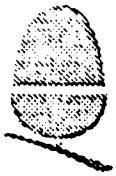
continued over ...

TO CLAIM YOUR 'FREE' WORDPROCESSOR, YOU MUST RETURN THIS FORM TO:-

Acorn Registration Department
P.O. Box 22
Wellingborough
Northants NN8 2RE

0476,021-1 JUNE 87

User Response



USER RESPONSE FORM

Name:

Address:

Postcode:

EXAMPLE

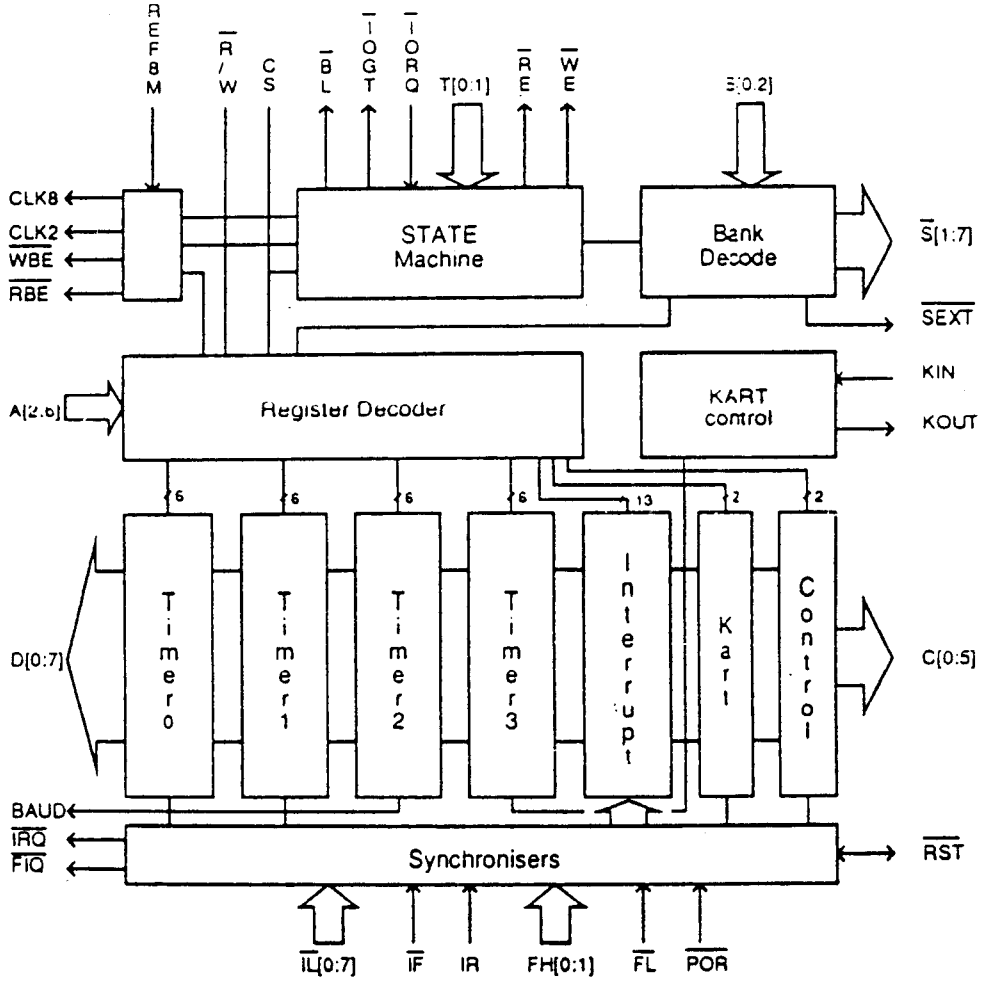
Unit Serial Number: [ ] [ ] - [ ]

eg 01 AKB10 30040557

Memory size (please tick) 1Mb [ ] 1/2Mb [ ]

Please describe the problem, query or suggestion as fully as possible.

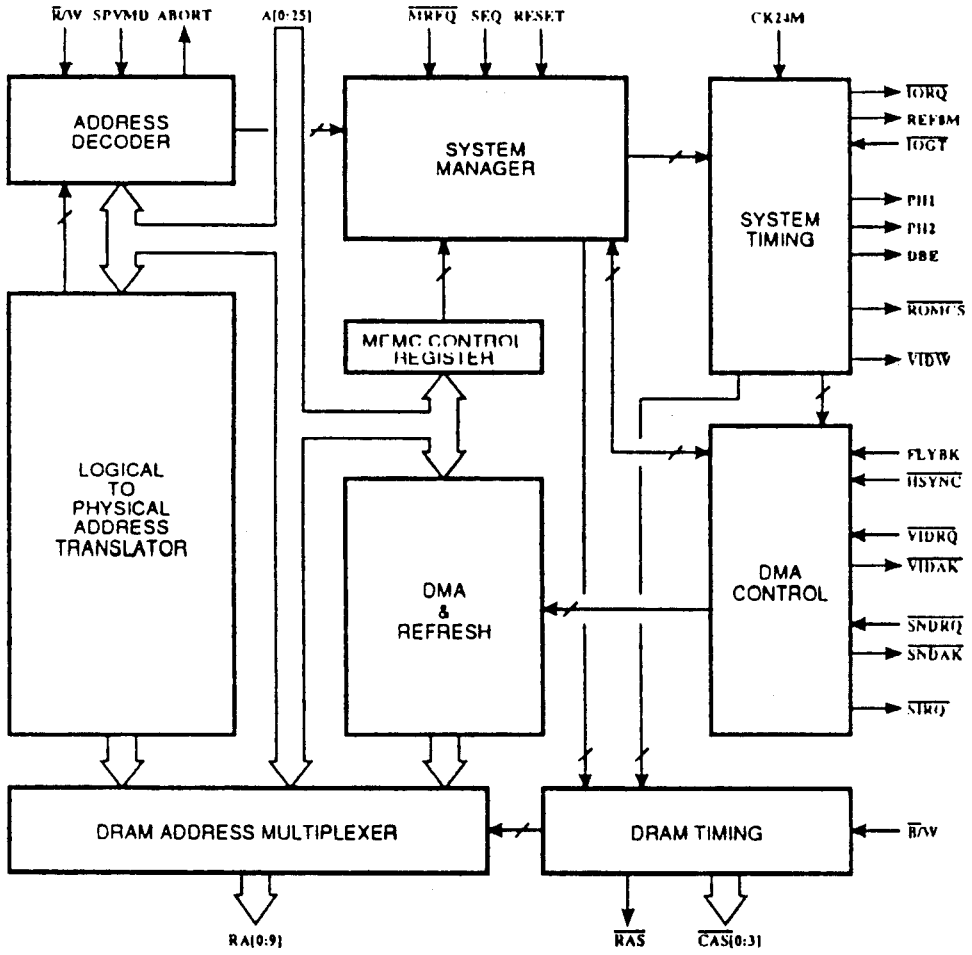
The IOC Chip Internal Structure



Features :-

* Power-on Reset Control
* 4 independent 16 bit programmable counters
* Bi-directional serial keyboard interface
* 6 Programmable bi-directional control pins
* Interrupt mask, request and status registers for $\overline{IRQ}$ and $\overline{FIQ}$
* 14 level-triggered interrupt inputs
* 2 edge-triggered interrupt inputs
* 4 programmable peripheral cycles
* 7 external peripheral selects
* ARM/IO bus interface control
* Expansion bus buffer control
* Fabricated in CMOS for low power consumption

The MEMC Chip Internal Structure



Features :-

* Directly drives standard Dynamic RAMs
* Supports up to 4MBytes of real memory
* Logical to Physical address translation
* Three protection levels supported
* Uses fast "Page mode" DRAM accesses to maximise memory bandwidth
* Internal DMA address generators for Video, Cursor and Sound data buffers
* Arbitrates memory between the processor and DMA
* Many ROM speeds supported
* Provides all critical system timing signals, including processor clocks
* Fabricated in CMOS for low power
* Provides "Refresh" for DRAMS
* Acts as interface between ARM and IOC, and VIDC, ROM and RAM

Instruction Set

Code	Comments
ASL	Arithmetic shift left.
LSL	Logical shift left.
ASR	Arithmetic shift right.
LSR	Logical shift right.
ROR	Rotate right.
RRX	Rotate right one bit with extend.
ADC	Add with carry.
ADD	Add without carry.
SBC	Subtract with carry.
SUB	Subtract without carry.
RSC	Reverse subtract with carry.
RSB	Reverse subtract without carry.
AND	Bitwise AND.
BIC	Bitwise AND NOT.
ORR	Bitwise OR.
EOR	Bitwise EOR.
MOV	Move.
MVN	Move NOT.
CMN	Compare negated.
CMP	Compare.
TEQ	Test equal.
TST	Test.
MUL	Multiply.
MLA	Multiply and accumulate.
B	Branch.
BL	Branch and link.
LDR	Load register.
STR	Store register.
LDM	Load multiple registers.
STM	Store multiple registers.

Table 2 Instruction Set

Further information on assembly language programming can be found in the Programers Reference Guide, Chapter 4, Section 6.

GOODS RETURN AUTHORISATION

GRA No.

ACORN COMPUTERS LTD
Cambridge Technopark
645 Newmarket Road
CAMBRIDGE
CB5 8PD
Tel: 0223 214411 Telex 81152 ACNNMR G
Fax: 0223 214382

Dead on Arrival	
Warranty repair	

Valid to:
DEALER COPY

Dealer Name and Address

Goods to be returned to:

Dealer contact/no	Invoice No.	Account No.	Raised by	Date

Item No.	Prod Code	Description	Cust Ref	Serial Nos	Qty	Fault Code	POP Req

Authorised for return by (NAME) Signature Date

Sheet 1

ARCHIMEDES Service Registration

June 1987

Dear Colleage,

All organisations approved to sell ARCHIMEDES product must also establish service facilities to ensure that the product may be repaired and serviced.

Please complete the following and return to Field Support and Services Dept., Acorn Computers Ltd., Unit 3, Cambridge Technopark, indicating your service arrangements.

Name of Organisation: _____

Address: _____

_____

_____

_____

Acorn Account No.: _____

Do you propose to undertake service of the ARCHIMEDES product yourself? **YES/NO**

If NO, please indicate the organisation who will undertake service on your behalf

Name of Service Organisation: _____

Address: _____

_____

_____

_____

ASC No.: _____

Doc.ref.: ServReg *Attachment G* *June 1987*

Service Support

The following pages give examples of the service support and procedures as laid down by Acorn Computers Limited.

Examples of GRA forms are included, both blank and completed.

FOR ACORN SQA USE ONLY

FR Ref:

Origin

Received on date: _____

Received from: As overleaf: ☐
Customer Services: ☐
Other Source: _____
Address _____
_____ Tel: _____

Referrals

Name	Position	Date

Correspondence

Give details of dates and reference of all correspondence

User Correspondence | Developers Correspondence

Description of Action

Describe what action is necessary. If no action is required, state why, e.g. user misunderstanding; already rectified, unable to duplicate, already notified.

Action Carried Out

Problem fixed in version _____ ECR Ref: ☐
Unable to fix problem _____
Work round _____

Completed Fault Report Approved: _____ Date: _____

11. Central Workshop receives package, records it, verifies contents and checks whether repair is in or out of warranty.

12. Central Workshop removes good replacement main PCB from buffer stock and despatches back to submitting service agent with an invoice if out-of-warranty.

13. Service agent receives replacement Archimedes main PCB and returns it to his buffer stock.

14. Central Workshop submits to Acorn :-

    a) copy of Service Report (submitted with returned main PCB) annotated with the following :-

       * whether PCB was NFF (no fault found)
       * fault symptoms
       * fault diagnosis and parts replaced

    b) report on condition in which main PCB received, and return method.

15. Acorn verifies in-warranty status of Archimedes main PCB, then :-

    a) Records details of change performed by service agent,

    b) credits the service agent with the handling charge,

    c) raises invoice to service agent if no fault found,

    d) contacts service agent if transit damage or misuse of facility is evident due to above procedure not being followed.

16. All other faulty modules, eg., PSU, mouse, keyboard PCB, disc drive, and all faulty replaceable fittings, eg., power lead, Window moulding, User Guides, etc., should be returned to Acorn Computers Ltd at Unit 3, Cmbridge Technopark, accompanied by the Archimedes Service Report duly completed. Replacement modules/fittings will be supplied free-of-charge, and the submitting service agent credited accordingly.

Mouse Test :-

This tests the three buttons on the Mouse and the movement of the Mouse left/right/up/down. Each of the Mouse buttons (left/middle/right) are displayed on the screen in turn, together with a pointer. Move the Mouse until the pointer is within the displayed button on the screen and press the corresponding Mouse button. The button displayed on the screen should disappear and the next button appear. If the button cannot be made to disappear then it will be impossible to continue the test. The keyboard/mouse must be rejected.

If everything is normal then the program moves on the the next test automatically.

Keys Test :-

The screen will clear to show a representation of keys in the main keyboard area. Test each key in turn by pressing it and ensuring that the picture of the key pressed disappears from the screen . This test must be done in the correct order, which is to start from the bottom line and work from left to right upwards. (ie, Caps Lock, Shift, Space, Alt, Ctrl, Shift, Z, X, C, V, etc.)

When all keys in the main keyboard area have been successfully pressed the screen will clear and display a representation of the rest of the keyboard area. Again, press each key in turn, following the guidelines above.

When all the keys have been successfully pressed, the instruction to press the RESET button (on the back of the keyboard) is displayed. Press RESET button. If it is OK the screen will clear and show :-

```
MOUSE TEST - PASSED
MAIN KEYBOARD TEST - PASSED
NUMERIC KEYPAD TEST - PASSED
RESET BUTTON TEST - PASSED
```

Note : A small delay is required between each key operation. If the screen stops clearing the characters as you press the keys, go back to the lowest, leftmost key left on the screen and start again from there. At anytime during this test, if pressing the required key also causes another key to be pressed at the same time, then the two keys pressed will be shown on the screen. Press Break to continue and try again carefully. If the same fault repeatedly occurs then it will be impossible to continue the test. The keyboard must be rejected. Similarly, if pressing the required key will not make the picture disappear from the screen, the keyboard must be rejected.

Screen Test

The operator is presented with a series of screen displays which are sequenced by pressing SPACE . The first three displays, each in a different mode, are of a series of white lines radiating from the top left hand corner across which a 3 coloured acorn cursor will travel from bottom left to top right where it will rest. The operator should look for the accuracy of the lines together with the movement and integrity of the cursor: with respect to the latter the operator should note the transparency of the image as it moves across the lines.

Following these displays are four test cards each surrounded by a contrasting border and consisting of 16 concentric circles beneath a horizontal band. The band is divided into 16 sections with a pale border highlighting the leftmost 8 sections. The object of the cards is to display 16 shades, the border must be mid-range. There is a test card for each of the three colour guns, i.e., red, green and blue, and one, the "grey scale" for all guns.

The operator should observe the 16 shades displayed and the mid coloured border, being particularly critical of the quality of the "grey scale" display. They should also note the integrity of each test card. The final test card is a display of 256 colours. The operator should assess the integrity of the display.

Disc Interface Test

The first part of this two part test checks the write protect. Following this the operator is prompted to replace Test Disc with disc formatted. The test continues with disc write, read and erase checks, giving a PASS/FAIL message for each one.

RS423 Port Test

This test is carried out automatically giving a PASS/FAIL message.

Printer Test

This test sends a test pattern to the printer. The pattern comprises of a repeated series of stepped lines each representing bits 0 to 7. The operator should look for missing or corrupted patterns.

Select option C or D depending on the attached printer. The tests will now progress following the sequence detailed below.

The screen will clear and display the message :-

LOADING - PLEASE WAIT

The screen will clear again and display the following :-

```
Memory Test
-----------

Phase one: incrementing pattern ....
Phase two: TRUE hierarchy ..........
Phase three: FALSE hierarchy .......
Phase four: Cycling bits ...........

PASS/FAIL message

Press SPACE to continue
```

If the UUT fails this test, then any further test results may be suspect, so the test can be stopped and the UUT repaired before retesting if so wished.

Battery Backed RAM Test

Screen display :-

```
Battery Backed Ram (BBR) test running

-----------------------------------

Reading BBR into main memory.
Checking read/write function of BBR
Re-loading configuration parameters

PASS/FAIL message

PRESS  SPACE  TO CONTINUE
```

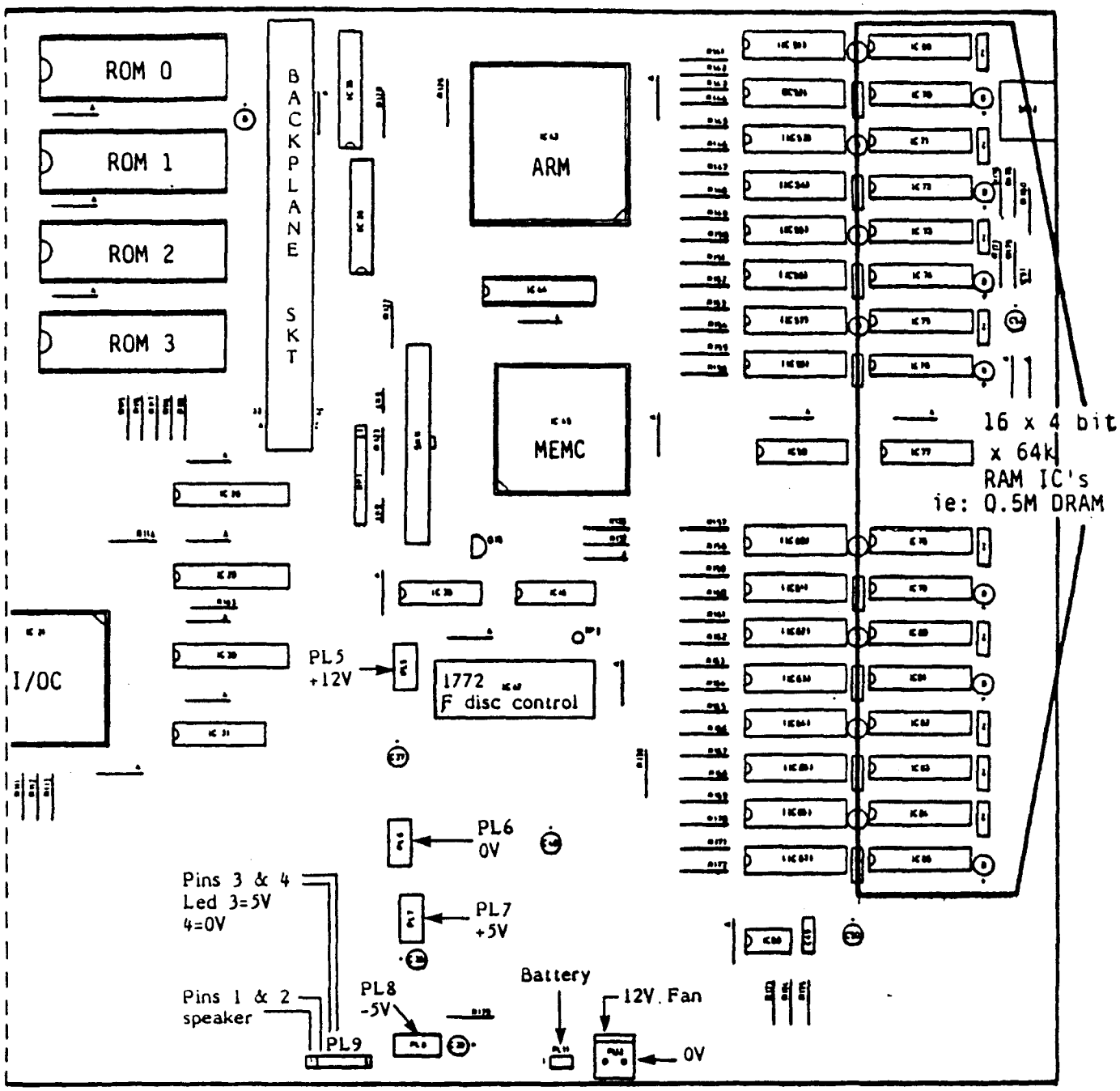


Figure 8.8 Simple Test Points (3)

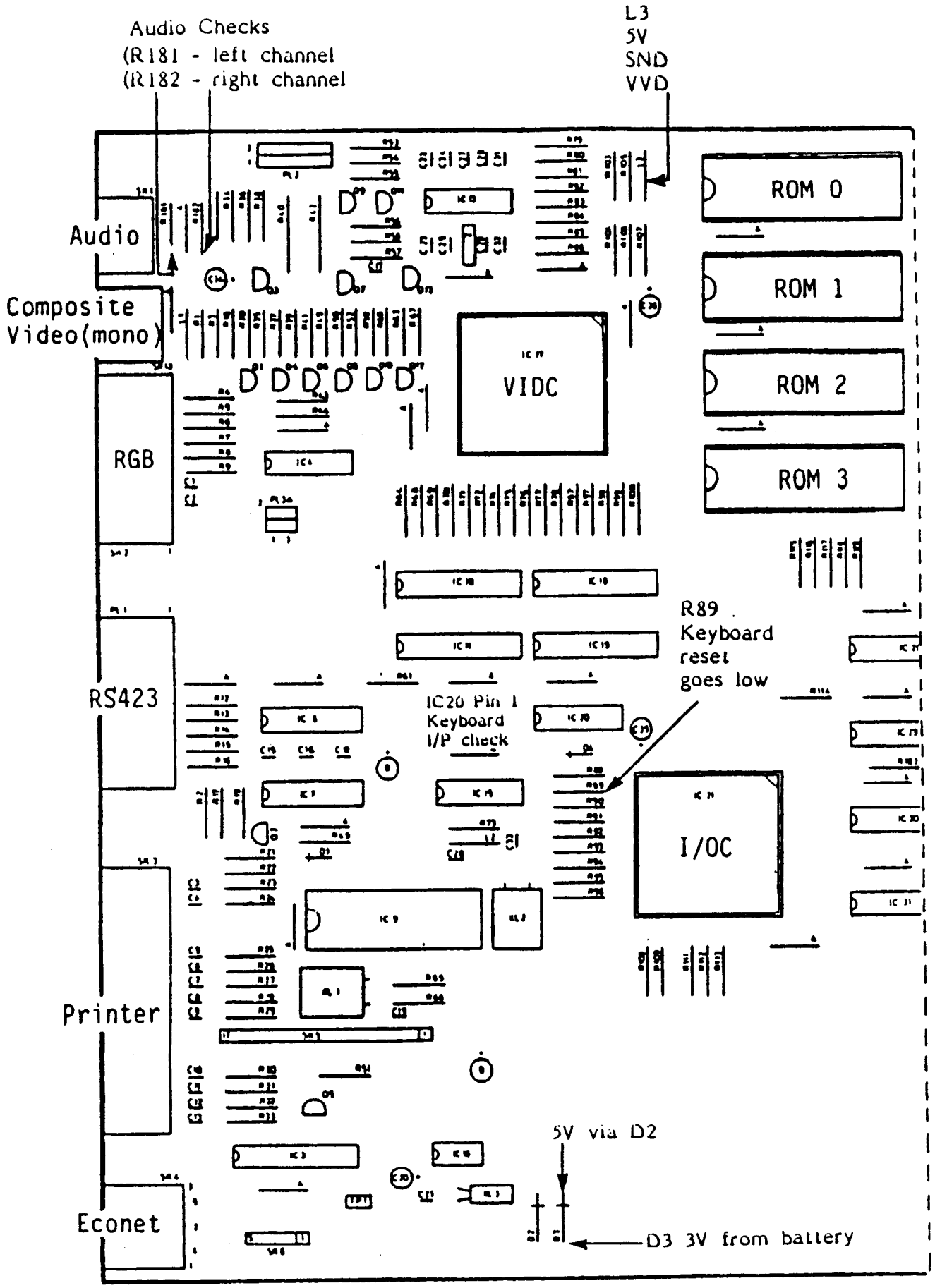
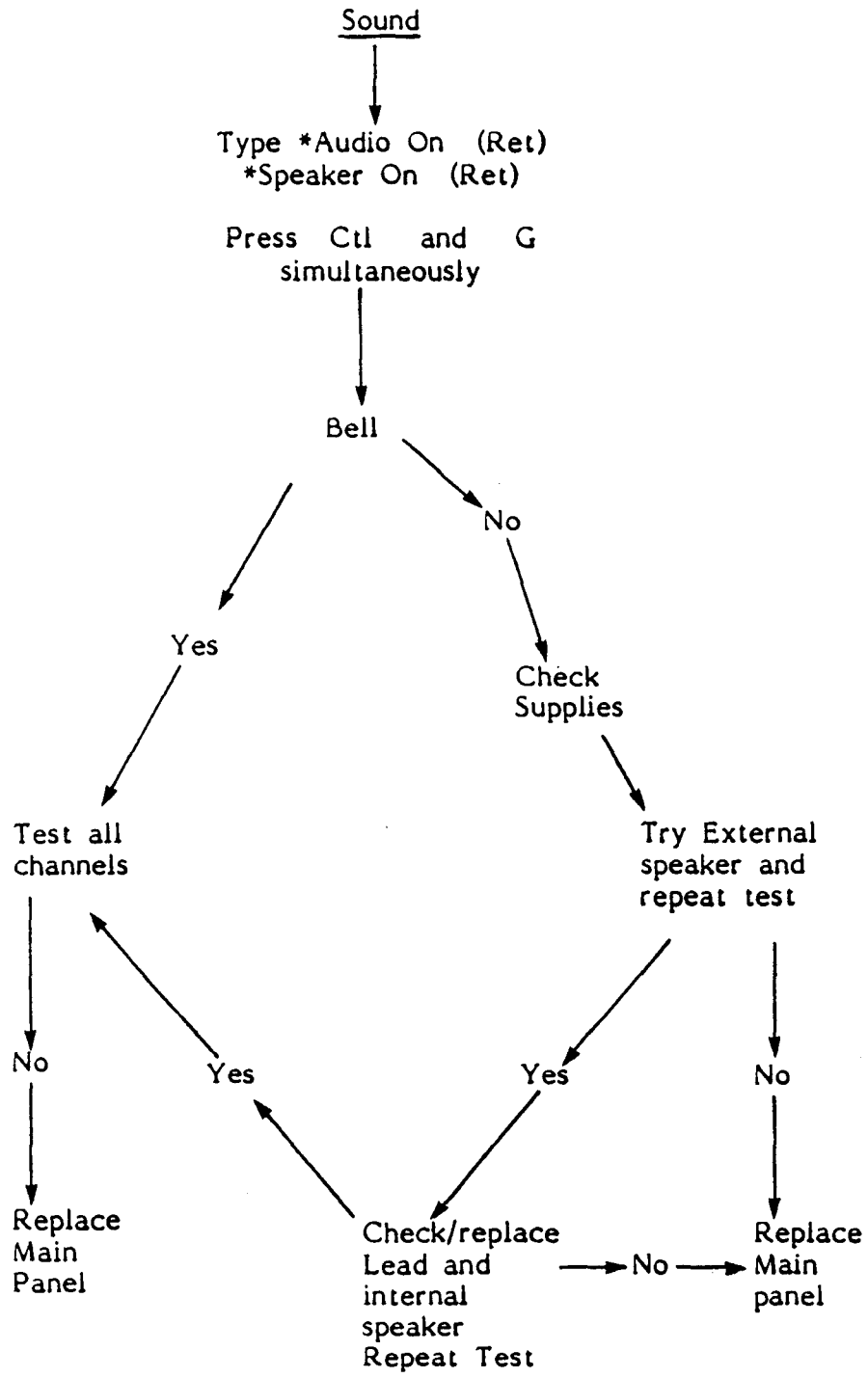


Figure 8.6 Simple Test Points (1)

Sound Fault Finding Guide

Symptoms - Sound faulty, VDU screen display present.



Main PCB Removal

Referring to Figure 8.5.

The main PCB is located via board locating clips at the front of the machine.

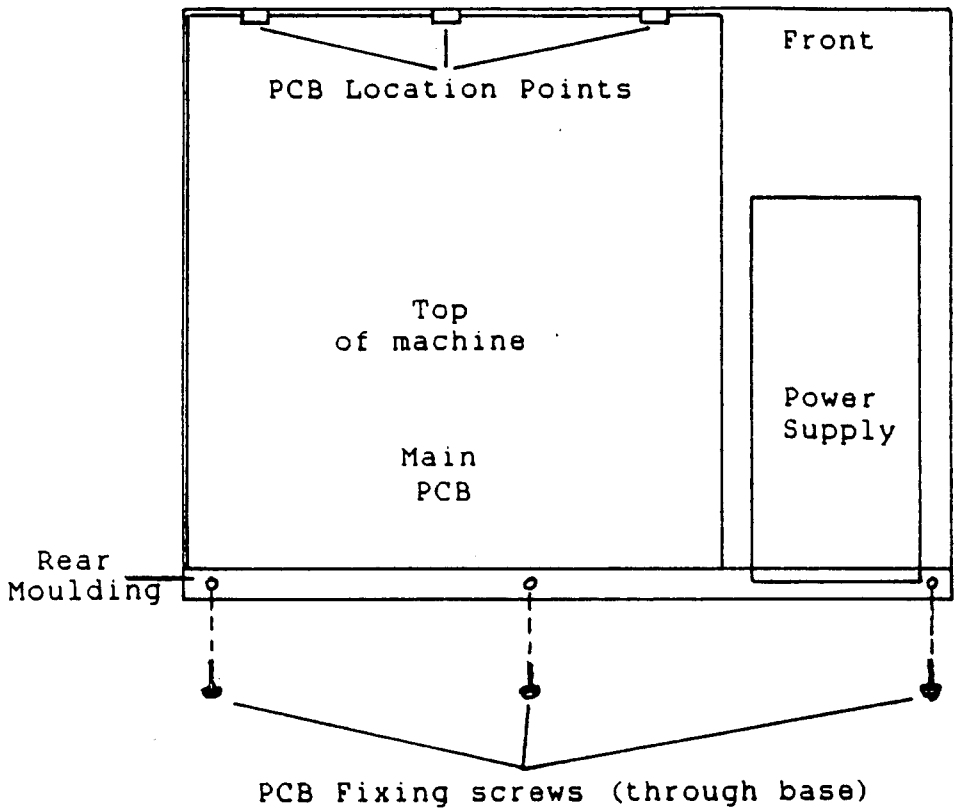


Figure 8.5 PCB Retaining Points

To remove the main PCB the following procedure should be followed :-

* Disconnect the machine from the mains.
* Slacken 2 x screws fitted, one either side of forward sides of machine.
* Remove 3 x screws fitted at rear upper case of machine.
* Slide upper case backwards and remove.
* Disconnect any relevant leads/plugs connected to main PCB.
* Remove Podules and backplane where fitted.
* Locate and remove 3 (2 + clip) x screws located at bottom rear of machine.
* Main PCB can now be removed by sliding towards the rear of the machine.

To refit the main PCB, reverse the above procedure taking care to avoid damage to any protruding components on the PCB.

Floppy Disc Drive

Referring to Figure 8.3.

The floppy disc drive ($3\frac{1}{2}$") is fitted with a 34 way ribbon cable supplying the bus. Power is supplied via a 4 pin plug. Access to the drive for removal is by firstly removing the upper case and front moulding. Two screws provide the required mechanical fixing onto the bracket across the RAM chip array.

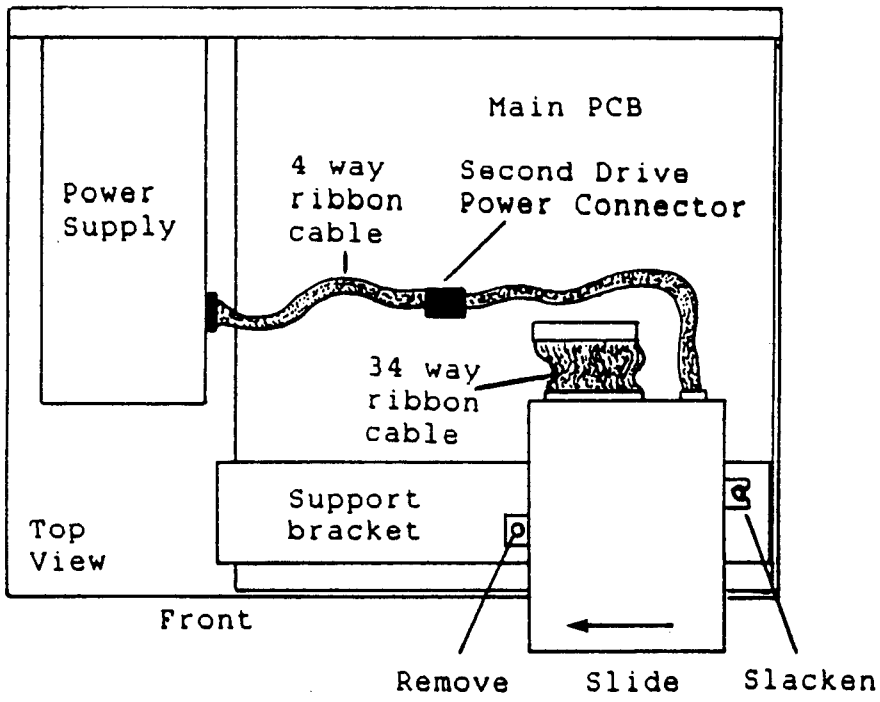


Figure 8.3 Disc Drive Connectors and Fixing Points.

To remove the disc drive assembly, slacken off the RHS screw and remove completely the LHS screw. Disconnect the ribbon cable. Slide the disc drive $\frac{1}{4}$" to the left and lift away.

Replacement is by reversing this procedure.

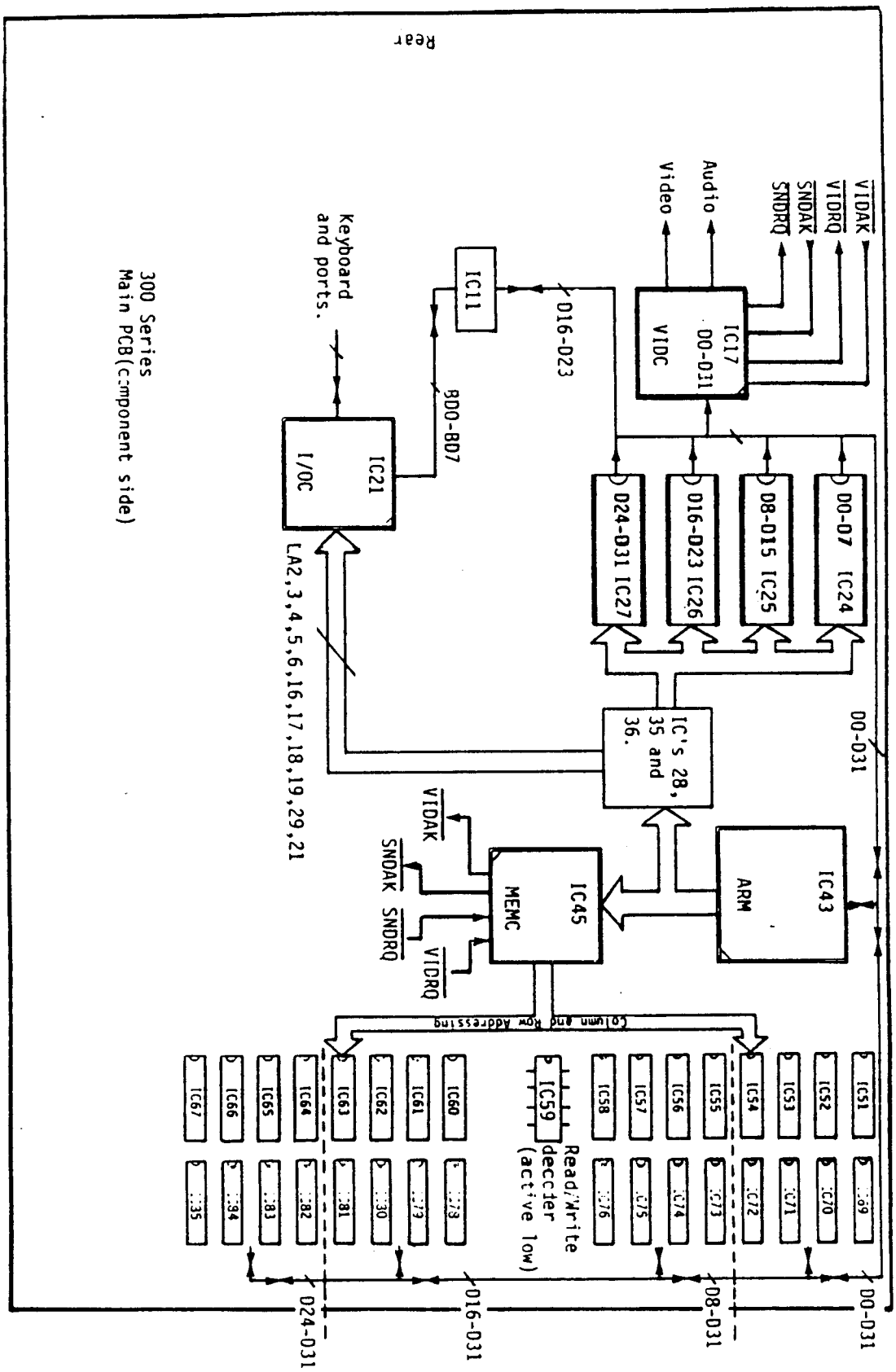


Figure 8.1 Archimedes 300 Series Main Address And Data Paths.

Notes

Notes

Mouse Cleaning

For details on cleaning the mouse, refer to pages 38-42 of the Welcome Guide.

Simple Diagnostics

Symptom	Check/Try	Remarks.
Display Faulty.	Monitor settings Monitor to computer lead. R RESET twice. Substitute monitor.	Brightness, Contrast, Shift, etc. Check by substitution. If a lack of sync. If the fault persists, probable computer fault. If fault clears then the monitor is at fault.
Dead.	Are both LED's lit? Just the monitor LED on? Just the computer LED on?	If not check mains fuse/supply. Computer faulty (power supply) Check the supply lead to the monitor. If okay monitor faulty.
No Display.	Press CONTROL and G and/or Enter *. RETURN. Try monitor lead. Try another monitor.	If the computer beeps then it's probably okay. If the disc rotates the computer is probably okay. By substitution.
Software will not run.	Try known good disc in suspect machine. Try suspect software in Check status/software requirements	If not okay check STATUS, (see below). If not okay see below. Is there enough sprite size set? Is there enough RMA space? If all okay suspect the computer.
Disc Problems.	Try suspect disc in known good machine. Try a known good disc in the suspect machine. Check STATUS of suspect machine.	If okay check STATUS (see below), if not suspect disc. (does an error report appear on screen)? If okay see below. Is the correct drive being selected? Is the STEP set to suit the type of drive? If all is set correctly suspect the computer.
Keyboard Problems.	Some keys inoperative Keyboard inputs are repeated on the screen too quickly. No operation.	Try another keyboard. If still faulty suspect the computer. Suspect incorrectly set STATUS. Perform an R RESET to return the computer to the default settings. Disconnect the keyboard and switch the computer OFF then ON again. The computer should AUTO BOOT the disc drive. If not suspect the computer. If okay replace the keyboard.
Configuration lost or varies.	Suspect the batteries.	Check by substitution. If the fault persists suspect the computer.

Batteries and Battery Holder

Referring to Figure 7.2.

Two 1.5V (AA size) manganese alkaline cells, such as Duracell, are supplied fitted in a carrier.

These supply the current requirements for a 256 byte static ram chip.

The approximate life of these batteries is one year and should be replaced within one year to ensure non loss of data in RAM.

The battery holder has a series wiring configuration.

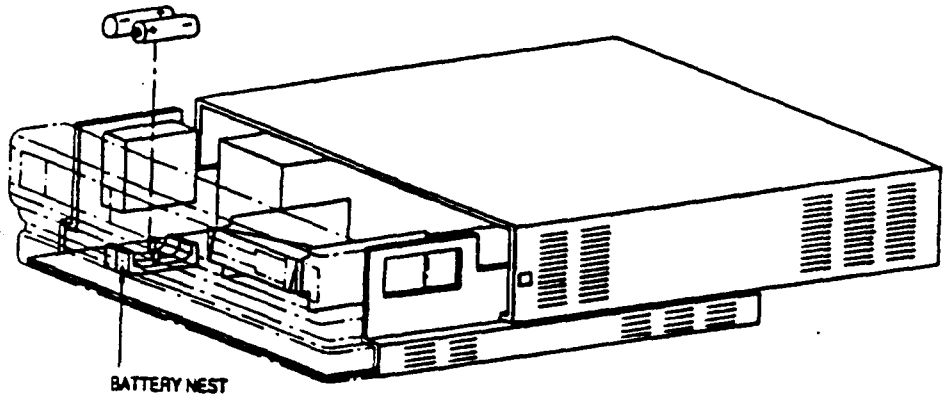


Figure 7.2 Location of Battery Holder

Battery Replacement

Referring to Figure 7.3.

With upper case and front removed, use blunt screwdriver or similar to prise old batteries out and replace with new batteries observing correct polarity.

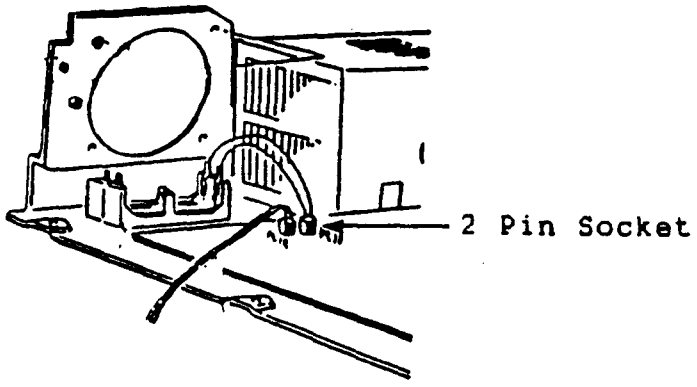


Figure 7.3 Location of Battery Socket

Notes

```
21,"Negative root"
22,"Logarithm range"
23,"Accuracy lost in Sine/Cosine/Tangent"
24,"Exponent range"
26,"Unknown or missing variable"
26,"Can't use array reference here"
27,"Missing )"
27,"Missing "
27,"Missing ."
20,"Number too big"
27,"Missing "
28,"Bad Hex"
28,"Hex number too large"
28,"Bad Binary"
29,"No such function/procedure"
30,"Bad call of function/procedure"
31,"Arguments of function/procedure incorrect"
31,"Invalid RETURN actual parameter"
32,"Not in a FOR loop"
33,"Can't match FOR"
34,"Bad FOR control variable"
35,"The step cannot be zero"
36,"Missing TO"
38,"Not in a subroutine"
39,"ON syntax"
40,"ON range"
41,"No such line"
42,"Out of data"
43,"Not in a REPEAT loop"
45,"Missing "
46,"Not in a WHILE loop"
47,"Missing ENDCASE"
48,"CASE statement must be the last thing on a a line
49,"Missing ENDIF"
50,"Bad MOUSE variable"
51,"Too many input expressions for SYS"
51,"Too many output variables for SYS"
```

More Line Numbers

The maximum line number has been increased from 32767 to 65279 to help deal with the longer programs possible. The end of the program is thus indicated by &0D and &FF where before any byte with the top bit set would have worked. It is, therefore, possible that there will be some program binary images which will give "Bad program" when LOADed into BASIC V. The RENUMBER command has been improved to notice the overflow from the maximum line number.

Basic Editor

The basic screen editor supplied with the Archimedes provides full screen editing in a similar way to the Acorn soft Basic Editor. It provides many editing features including automatic numbering, line marking, block moving, search and replace, and many more. A full description of the editor and its use is given in the User Guide, chapter 25.

The editor can be loaded from the Welcome Disc (first 2000 machines only) by typing *RMLOAD $.MODULES.ARMBE

Revised Error Descriptions

0,"Silly!"

0,"No room to do this renumber"

0,"Line numbers larger than 65279 would be generated by this renumber"

0,"No Room"

0,"Stopped"

0,"Invalid LISTO option"

0,"Invalid EDITO option"

0,"Corruption of stack"

0,"Error control status not found on stack for RESTORE ERROR"

0,"Missing incore name"

0,"LIST/EDIT found line number reference"

0,"HELP has no information on this keyword"

1,"No such mnemonic"

1,"No such suffix on EQU"

2,"Bad immediate constant"

2,"Bad address offset"

2,"Bad shift"

Pitch :
The pitch can be controlled in steps of a quarter of a semitone by giving a value between 0 and 100. The lowest note (0) is the B one octave and a semitone below middle C. The highest note is the D four octaves and a tone above middle C. A value of 53 produces middle C itself. The following table is a quick reference guide to help you to find the pitch you require.

	Octave Number					
Note	1	2	3	4	5	6
A		41	89	137	185	233
A#		45	93	141	189	237
B	1	49	97	145	193	241
C	5	53	101	149	197	245
C#	9	57	105	153	201	249
D	13	61	109	157	205	253
D#	17	65	113	161	209	
E	21	69	117	165	213	
F	25	73	121	169	217	
F#	29	77	125	173	221	
G	33	81	129	177	225	
G#	37	85	133	181	229	

Duration :
This determines the duration of a sound. A value of 0-254 specifies the duration in twentieths of a second. For example, a value of 20 causes the note to sound for one second. A value of 255 causes the note to sound continuously, stopping only when you press Esc.

The Beats Statement

The channels can be sychronised by using the beat counter. You can set the value that this counter is to count up to by typing :-

```
BEATS n
```

The counter then counts from '0' to 'n' and when it reaches 'n' it resets itself to zero. To find the current beat counter value type :-

```
PRINT BEATS
```

The Beat Statement

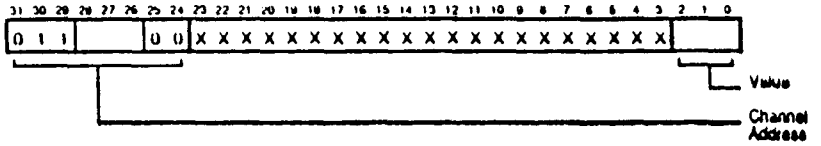
In addition, the current beat value is found by typing :-

```
PRINT BEAT
```

Sound

Sound generation is defined in the VIDC, (Video Controller IC). Up to 8 possible channels are available, each capable of presenting a stereo image.

Stereo Image Registers, Channels 0-7 : Addresses 60H-7CH



These 8 registers define the stereo image position for each of the 8 possible channels as shown below :-

Address (Hex)	Register
60	Stereo Image Register 7
64	Stereo Image Register 0
68	Stereo Image Register 1
6C	Stereo Image Register 2
70	Stereo Image Register 3
74	Stereo Image Register 4
78	Stereo Image Register 5
7C	Stereo Image Register 6

The least significant three bits set a value between 0-7 which sets the audio image effects of any sound register.

Value	Audio Effect
0	Undefined
1	100% left
2	83% left
3	67% left
4	centre
5	67% right
6	83% right
7	100% right

QUIT	leaves the interpreter
RECTANGLE x,y,a,b	rectangular outline, position x,y width a,height b
RECTANGLE FILL x,y,a,b	rectangle fill
RECTANGLE x,y,a,b TO u,v	move rectangle to u,v
SOUND OFF	turns the sound off (with *fx210)
SOUND ON	turns the sound on (with *fx210,0,0)
SWAP <lv>,<lv>	SWAP can also interchange arrays eg SWAP A0,B0
WHEN	Part of the CASE... OF... WHEN... OTHERWISE... ENDCASE statement
WHILE	Statement marking the start of WHILE... ENDWHILE loop.

New Functions

END	returns top of memory used:
	equivalent to DIM p%-1
GET$#<channel>	gets string to next CHR$10 or CHR$13 (or EOF)
LEFT$(<string>)	returns the left LEN string -1 characters
REPORT$	function that returns the error REPORT as a string
RIGHT$(<string>)	returns rightmost character

New Binary Operators

<<	arithmetic shift left by the number of bits given by righthand side
>>	arithmetic shift right by the number of bits given by righthand side
>>>	logical shift right by the number of bits given by righthand side

<<,>> and >>> have equal priority to the ordinary relations and, like them, one cannot write a >> 4 << 2; it would have to be (a >> 4)<< 2

New Unary Operators

%	binary constants eg %1010101 is &55
!	floating point indirection like $ eg Var%

Notes

Econet Station

Typically a BBC microcomputer with ANFS/NFS(*) fitted, the station can provide the user with total access to his files/directories and access to other user files at the discretion of the file owner.

Additionally, any station can communicate with the outside world via the VDU at the station or provide a hard copy via a printer.

Master Econet Terminal (128Kbyte RAM, 64Kbyte ROM)
Master Compact (128Kbyte RAM, 64Kbyte ROM)
Master 128 (128Kbyte RAM, 128Kbyte ROM)
Master Turbo (196Kbyte RAM, 132Kbyte ROM)
BBC Model B (32Kbyte RAM, 32Kbyte ROM)
BBC Model B+ (64Kbyte RAM or 128Kbyte RAM, 48Kbyte ROM)
Acorn Cambridge Workstation 443 (4Mbyte RAM, 112Kbyte ROM)*
Cambridge Co-processor module for Master 128, BBC Model B (B+)(1Mbyte RAM, 16Kbyte ROM)
BBC Archimedes Model 305 500Kbyte RAM, 500Kbyte ROM
BBC Archimedes Model 310 1Mbyte RAM, 500Kbyte ROM
Acorn Archimedes Model 400 series

Note : all models listed above except the Master Econet Terminal and the Acorn Cambridge Workstation, must be fitted with an Econet interface before they can be used on the network.

A user guide describing Econet services is included with each Econet workstation.

Linking The Network

The Econet network is linked via a 4 wire lead and screen which terminates in a 5 pin din 180^{o} plug.

Interfacing Econet

In order for the microcomputer to work with the system a network station number must be utilised.

In the Archimedes this is the ANFS (Advanced Network Filing System) (built into Arthur)

This can be set via the configuration to be the default filing system at switch on.

An upgrade is required to be installed in the mother board to provide Econet interfacing. A small plug in module is available.

Filestore E01

Two 3.5 inch floppy disc drives with a 1.2Mbytes of storage.

Controller board with :-
64K ROM containing file-server software
64K RAM 65C102 processor
Parallel printer interface
Filestore expansion bus
Econet interface module
*Econet clock and termination circuits
Real time clock unit and RAM maintained by rechargeable battery
Switch mode power supply
Fan

*Short networks only

Filestore E20

This unit is designed to operate connected to the E01 Filestore expansion bus and contains :-

One 3.5 inch 20Mb Winchester disc drive
Switch mode power supply
Filestore expansion bus socket
Fan
Host adaptor PCB (1Mbyte bus < > SCSI)

Level 2 File Server

Equipment required :-

Master Turbo fitted with Econet interface module, 800K dual floppy disc drive.

OR

Master 128 fitted with Econet interface module, 800K dual floppy disc drives, 6502 Second Processor

OR

BBC Model B (B+) with Econet interface, 800K dual floppy disc drives, 6502 Second Processor.

Includes :-

File server software (floppy disc)
Econet Level 2 User Guide
Econet Level 2 Manager's Guide

Notes

Common Commands for ADFS

To select/enable the disc drive system/drive.
*ADFS *DRIVE *MOUNT

To make and check a blank disc ready for initial use.
*FORMAT *VERIFY

To create/amend a file or a directory.
*CDIR *CREATE *SAVE *BUILD *SPOOL *SPOOLON *APPEND *ENUMDIR *URD *LIB

To move through directories.
*DIR *BACK *UP

To duplicate a file(s).
*BACKUP *COPY

To transfer a file from disc to memory.
*LOAD *RUN *EXEC

To set/remove the level of file security.
*ACCESS

To erase a file from the disc.
*DELETE *WIPE *REMOVE

To close a file on disc and/or leave the current filing system.
*SHUT *CLOSE *BYE *DISMOUNT *SHUTDOWN

To obtain directory/file details.
*INFO *EX *LEX *CAT *LCAT

***Copy**

Using this command it is possible to copy files from one DIR to another. For example :-

```
*COPY $.dir1.dir2.prog# $.dir3.
```

All files in DIR$dir1.dir2 are copies over to $dir3.

Help can be obtained on the *copy command by typing

```
*HELP COPY OPTIONS
```

***CAT**

This allows all of the directories and files to be listed. For example :-

```
*CAT $.DIR1
```

A list of directories within DIR1 will be listed.

```
*CAT $
```

A list of directories within $ will be listed.

***Info**

This command gives information about the size of a file or directory on the disc. For example :-

```
LANDER      WR    BASIC   00:05:28 01-JAN-1900   000000A1  0005B400
```

Filename | Atribute | File Type | File Save Date and Time | Size in Bytes | Start Address on Disc

OR

```
GAMECODE    WR    0008000  0000A614  00009A10  0005B8000
```

Filename | Attribute | Load Address | Execute Address | Size in Bytes | Start Address on Disc

Formatting

In order for a disc to be able to accept data, it has to be prepared or Formatted.

This process involves the writing of sectors and tracks on the disc in a pre-determined FORMAT, and a reference file being set up in track 0 to refer to any track or sector.

Any information on a disc will be lost when formatting takes place.

The ADFS system allows for two formats to take place :-

1. Formatting the disc to hold 640k bytes of information
2. Formatting the disc to hold 800k bytes of information

To format a disc simply type in the line below :-

*FORMAT 0 (SIZE)

Note that (SIZE) refers to either L for 640k bytes or D for 800k bytes.

Pressing return will now display the prompt :-

"Are you sure (Y/N)?"

Y will format the disc, N will abort the operation.

640k bytes formatted allows up to 47 directories from the root directory or 47 files from the root directory and up to 47 directories or files from each directory down from the root directory.

This size formatting gives compatibility with the master/compact series providing no non-compatible commands are used, i.e., "colour" or "Shadow RAM". The Arthur ADFS can also read/write a pre-formatted disc with a capacity of 320kbytes.

800k bytes formatted allows up to 77 directories from the root directory and so on as above, but 77 is always the maximum number.

Drive Numbering

Referring to Table 5.1.

Arthur ADFS can support up to four floppy disc drives and four Winchester disc drives.